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ON THE FRESH-WATER SHELL-HEAPS OF THE ST.
JOHNS RIVER, EAST FLORIDA.

BY JEFFRIES WYMAN, M. D.

[Concluded from page 463.]

II. ARTICLES TAKEN FROM THE SHELL-HEAPS, SHOWING
HUMAN AGENCY.

Pottery. In the old world no traces of pottery have been found associated with the earliest flint-implements, and it is therefore concluded that the men who wrought these were ignorant of it. When the European first came to America, some of the tribes were found to be destitute of this art. The Patagonians had no earthen vessels either for cooking or holding water. Instead of such the Esquimaux used wooden bowls, and the natives of the North-west Coast, Oregon and California, water-tight baskets, substituting heated stones for the direct action of fire. But with few exceptions pottery, as an art, was practised by a large majority of the tribes.

If, as daily experience tends to show, man, when first introduced upon the surface of the earth, was at best a pure savage without experience, it follows as a natural consequence that there must have been a longer or shorter time when instruments were unknown to him. We have no adequate grounds for any other belief, than that his knowledge

and his inventions have been progressively developed, and analogy, as we think, legitimately suggests that the most simple inventions are signs of actual progress, and point back to an earlier state out of which he has emerged. The discovery of the oldest of man's works, either in the form of worked flints, earthen vessels, and of fire-hearths, do not carry us back to his beginning; if we would attain to a knowledge of this, it must be sought for in the remains of his own body, older than all his works.

We have as yet no data for determining the time or the order of his inventions. But of all his works thus far discovered, flint-implements are the most ancient, and earthen vessels the next. The invention of fire and cookery appears to have preceded that of pottery, the proof of the existence of the former being the oldest. The determination of how, and the period when, fire was first made available as an agent, would be one of the most important contributions to the history of the early progress of the human mind.

The shell-heaps on the St. Johns River, like those from the other parts of the United States, show that those who inhabited them were not, strictly speaking, primitive men. They had already made some progress in the useful arts, and however rude their instruments, these were nevertheless inventions, and such, too, as could only have been the result of experience extending through considerable periods of time. They not only used worked stone, bone and shell, but their pottery had passed out of the first and rudest stage into that of comely forms with outward ornament, and, as the table on the opposite page shows, exhibits some little variety in the composition of the materials.

For the purposes of comparison we have included in the enumeration, articles obtained from St. Johns Bluff, where the shell-heap is made up of salt-water species. The table shows that more than three-fourths, eighty per cent., of all the pieces were made of clay without the admixture of any other substance, and that when another substance was added,

it was most commonly palmetto fibre. The use of sand was almost exclusively confined to St. Johns Bluff, where, too, is found the most highly ornamented work, characterized by the most complex figures. The only pieces marked with the impression of a cord were also found at the same place. This kind of ornament was extensively used over the United States, as we have specimens from Illinois and Massachusetts, and has also been observed on the pots from tumuli belonging to the Pre-Roman period of Great Britain.* We have seen no evidence that, as has been frequently asserted, these markings indicate that the pots had been formed in nets. Although the meshes are often regular, there are no signs of knots at the point of crossing of the threads, which there certainly would have been if nets had been used. Traced pottery was confined almost wholly to Old Enterprise, the figures being made with a point, and consisting of combinations of straight lines. These were sometimes combined with indentations. We saw no specimens of pottery made in baskets, though frequently told that such are found. The absence of pounded shells, as one of the ingredients of their pottery, is worthy of notice, especially as shells were in daily use among the natives of the St. Johns.

LOCALITY.	MATERIALS.			SURFACE.				
	Clay.	Clay and Sand.	Clay and Veg. fibre.	Plain.	Traced.	Plain stamped.	Complex stamped.	Marked with Cord.
Lake Harney,	106	0	0	8	2	90	0	0
Burial Mound do.,	38	0	2	32	1	7	0	0
Watson's Landing,	62	0	15	67	0	10	0	0
Black Hammock,	210	0	0	142	0	68	0	0
Old Enterprise,	23	2	92	64	50	3	0	0
Old Town,	126	0	13	60	1	78	0	0
St. Johns Bluff,	27	28	0	14	1	16	18	12
Total number of pieces,	592	30	122	387	55	272	18	12

The plain-stamped pottery was universally distributed, but was most abundant at Lake Harney and Black Hammock,

* Sir John Lubbock. Prehistoric Times. London, 1865, p. 113.

and is characterized by square, oblong, or lozenge-shaped impressions, regularly arranged, the stamp being of sufficient size to make a large number of them at once, but very often the figures are confused in consequence of the instrument having been applied twice to the same region. In one case the apex of the spine of a *Paludina* had been used as a stamp. The complex figures on the pieces from St. Johns Bluff, consist of combinations of square, with more or less rounded or curved impressions, giving the whole surface an intricate series of markings, but which we were unable in any specimen found, to reduce to a definite plan. They, however, resemble in their general style the pottery described by Schoolcraft* as coming from the sea-coast, and remind one of Mexican forms.

The size of the vessels, as indicated by the curvature of the fragments, varied from between two and three to twelve inches. The more common kinds appear to have been either shallow like a common pudding-dish, or deep enough to be used as seething-pots, and both are figured in the illustrations to the *Brevis Narratio* of Le Moyne.†

Fig. 1, Pl. 10 (natural size), represents a rude attempt at ornament, consisting of two irregular parallel spiral lines starting from the same point. From Old Enterprise.

Fig. 2, Pl. 10 (natural size), also from Old Enterprise. In this, as was not unfrequently the case at the locality just mentioned, straight lines are combined with indentations made with a round point.

Fig. 3, Pl. 10 (natural size), represents one of the instances of complex figures from St. Johns Bluff. This was made either by one large complicated stamp, or by a series of different stamps, since none of the details are exactly repeated.

Articles of Shell and Bone. The natives of the upper portions of the river were in constant communication with the

*North American Indians, Vol. III, Pl. XLV.

†De Bry, Hist. Amer. Francforte ad Menam. Pars. 2da, pp. 4 and 5.

coast, and, as might be expected, carried marine shells into the interior, some of which were converted into useful articles, especially *Strombus gigas*, *Pyrula carica*, and *P. per-versa*, the last acquiring a length of from twelve to fourteen inches.

Fig. 4, Pl. 10 (half natural size), one of the most common instruments, is made of a triangular piece cut from *P. carica*, so as to comprise a portion of the rostrum, serving as a handle, and a portion of the swollen part of the body, which is the useful part of the tool. The sides and apex are smoothed and rounded, while the base is regularly curved and ground to an edge like that of a gouge, but with the bevel on the inside. A specimen presented to me by Dr. H. P. Bowditch, and which he obtained at Old Enterprise, shows quite clearly that it was detached from the shell by first cutting a groove, and then breaking off the fragment. Length from 80 to 90 m. m., breadth from 60 to 70 m. m.

Fig. 5, Pl. 10 (half natural size), represents a species of *Pyrula*, with thick and heavy walls; the lip and nearly the whole of the rostrum are ground off, and a somewhat irregular oval hole with rounded edges is made between the first and second row of tubercles, and quite near to the mouth. Though such an instrument would give resonance to the voice, the position of the hole is not such as to adapt it most favorably to be used as a horn. It may, nevertheless, be the instrument which Bartram states was still in use when he visited the St. Johns, and with which, he says, "on one and the same day, early in the morning, the whole town is summoned by the sound of a conch-shell, from the mouth of the overseer, to meet in the public square," for the purpose of entering upon the work of cultivating the soil.*

Fig. 6, Pl. 10 (natural size), is a portion of the rostrum of *Pyrula*, 60 m. m. in length, the two ends of which have been obliquely ground.

Fig. 7 (natural size), a piece of bone with a central cavity,

*Travels in Florida. Philadelphia, 1791, p. 512.

into which a hole has been drilled at each end. This was found at Horse Landing, midway between the top and base of the shell-heap, and was the only object found actually within the shell-heap, which was clearly the work of the human hand. Nearly similar forms are figured in the plates of the *Brevis Narratio*, as forming a part of the necklace worn by the natives.*

Fig. 8, front view; fig. 9, side view (natural size), represents an instrument made of shell, which, from the exterior markings seen in some, and the thick ridge on the inside in nearly all,



appears to have been cut from the borders of the mouth of *Strombus gigas*. Several of these were found, but all more or less broken. When whole the length was about 150 m. m., breadth from 50 to 60, and the thickness 25 to 30 m. m. The broad end is ground to a blunt edge like that seen in most of the stone chisels from the other



States, and the other as ground to a blunt point. The instrument closely resembles the shell-adze used by the Kingsmill islanders, specimens of which, with their handles attached, can be seen in the Smithsonian collections. One of the specimens has been twice perforated by a *Lithodomus*, and thus so far weakened as to lead to fracture. These perforations were undoubtedly made before the instrument was wrought. Its outer surface is largely bored by worms.

A large specimen of *Pyrala perversa*, from which the interior whorls had been broken out, was found at Blue Spring. Such as this were used as drinking horns, and

* Plates XXXVI, XXXVIII, XXXIX.

are mentioned by Le Moyne, though his figures, drawn from memory, as might be expected, do not agree with this or any other species.

Besides the implements of bone already mentioned, a portion of the radius of a bear, which had been divided by cutting a groove around the outside and breaking the rest, was found at Old Town; and Mr. Bowditch gave me the antler of a deer which had been similarly treated, and which he found at Enterprise.

Articles of Stone. The collection of stone implements was quite small, only twenty-five or thirty pieces, nearly all of which were picked up on the shores near Old Enterprise, only a few being actually dug from the mounds. A single chisel of the ordinary form, and with a remarkably sharp edge, was found at Old Town, but all the other articles were either arrow or spear-points, and none of them had unusual shapes. No pipes or fragments of them were found at any place.

Fig. 10, Pl. 10 (half natural size), represents the rude attempt at an arrow-head, mentioned on p. 403, and found by Mr. Peabody under the lowest portion of the shell-heap at Horse Landing.

We will add to the above two pieces of worked shell, both of which were, however, taken from the burial-mound at Black Hammock, near the shell-heap, but were undoubtedly in common use among the natives.

Fig. 11, Pl. 10 (natural size), is an ornament cut from that portion of a *Pyruca*, namely, the suture, where one whorl joins the preceding, and is bent to nearly a right angle; the length of the upright portion is 45 m. m., and the disk at the bottom measures 31 by 24 m. m.

Fig. 12, Pl. 10 (natural size), a disk of shell, 18 m. m. in diameter, and 5 m. m. thick, with a hole drilled through the centre. A similar one is figured by Schoolcraft.*

Remains of Animals. The subjoined table gives a com-

*Notes on the Iroquois. Albany, 1847, p. 243.

plete list of the different kinds of animals, indicated by the bones found in the different mounds. The species most commonly met with are the Deer (*Cervus Virginianus*), the Terapin (*Emys Floridana*), Soft-shelled Turtle (*Trionyx ferox*) and the Alligator (*Alligator Mississippiensis*). The condition of the bones in many instances, particularly those from Old Enterprise and Horse Landing, indicated that they had been long buried, inasmuch as they had lost nearly all their organic matter, and when exposed to heat scarcely changed their color. In many instances they were incrustated with a deposit of lime, and had the shells in which they were embedded cemented to them. The bones of birds are quite rare, even those of the wild turkey and of the various species of ducks, which in the winter frequent the rivers and lakes in immense numbers. Of fishes, the species most commonly represented are the gar-pikes (*Lepidosteus*), and a cat-fish (*Pimelodus*).

In the illustrations to the *Brevis Narratio* of LeMoynes, Pl. XXIV represents a fire over which is built a frame, and on this, exposed to heat and smoke, are several animals, among which can be recognized the deer, a small mammal, the mouth of which resembles that of the opossum, an alligator, an eel or a snake, and several species of fish. Several Indians are standing near, one fanning the fire, and another holds an alligator under his arm. On Pl. XXIII, natives are represented carrying food in baskets, one of which contains a deer, a fish, and an alligator. This is quite too large a load for one basket, and too much importance must not be attached to these plates, since they were drawn from memory, but they may be taken as an indication of what the kinds of food were. In the text, the writer states that they "ate freely of the flesh of the alligator, which is white and clean, and which we should have eaten often had it not been too redolent of musk."* This objection we have found from personal experience to be a valid one.

* Ibid., p. 5.

SPECIES OF ANIMALS FOUND IN THE SHELL-MOUNDS.	Lake Harney.	Watson's Landing.	Black Hammock.	Enterprise	Blue Spring.	Mt. above Ocala.	Oldtown.	Horse Landing.
Deer, <i>Cervus Virginianus</i> ,	*	*	*	*	*	*	*	*
Bear, <i>U. sus</i> ,	*	*	*	*	*	*	*	*
Raccoon, <i>Procyon lotor</i> ,	*	*	*	*	*	*	*	*
Opossum, <i>Didelphys</i> ,	*	*	*	*	*	*	*	*
Turkey, <i>Meleagris gallopavo</i> ,	*	*	*	*	*	*	*	*
Birds, not known,	*	*	*	*	*	*	*	*
Terrapin, <i>Emys Floridana</i> ,	*	*	*	*	*	*	*	*
Soft-shelled Turtle, <i>Trionyx ferox</i> ,	*	*	*	*	*	*	*	*
Species of Turtle not known,	*	*	*	*	*	*	*	*
Alligator, <i>Alligator Mississippiensis</i> ,	*	*	*	*	*	*	*	*
Catfish, <i>Pimelodus</i> ,	*	*	*	*	*	*	*	*
Gar-pike, <i>Lepidosteus</i> ,	*	*	*	*	*	*	*	*
Fish, not known,	*	*	*	*	*	*	*	*

That the animals of the shells which form the materials of the mounds were used as food, there seems to be no reasonable doubt. Unios are known to be edible, and, almost exclusively, form the shell-heaps on the borders of other rivers as the Ohio,* the Tennessee,† the Concord, etc.‡ We are not aware of any evidence that Ampullarias and Paludinas have been so used elsewhere than in Florida, but their association with pottery, and charcoal, and the bones of edible animals, seems to be decisive. If the inference we have drawn be correct, then it follows that the animal food of the ancient inhabitants of Eastern Florida was very largely derived from these species, and especially the Paludinas, since the remains of fish, turtles, alligators, and deer, form so insignificant a portion of the whole heap.

In view of the vast number and size of the shell-heaps now known to be scattered along the Atlantic coast,§ and the vast quantities of shells which compose them, it is quite clear that the aborigines must have depended largely upon shell-fish for food. In fact such was obviously the case with the early inhabitants of the old world as well as new. Of the

* Atwater, *Archæologia Americana*, Vol. I, p. 225.

† Brinton, *Smithsonian Publications*, 1896, p. 356.

‡ J. Wyman, *Proceedings of Boston Society of Natural History*, Vol. XI. p. 243.

§ Dr. Joseph Leidy, *Proceedings of Academy of Natural Sciences*, 1866, has described the shell-heaps at Cape Henlopen, and should have been cited in our communication in the *NATURALIST* for December, 1867, but at that time we had not seen it.

extent to which vegetable substances were made use of, the shell-heaps offer no evidence; but it seems certain, that until the bow and arrow, the trap or the net were invented, the animal food must have of necessity been derived from such species as could most easily be obtained, and among these the shell-fish and the more sluggish reptiles would first attract attention.

III. AGE.

No satisfactory data were found for determining the age of the shell-heaps. The appearance of great age which some of them have, as at Horse Landing and Old Enterprise, is important; the same may be said of the fact that the bones embedded in them had lost nearly all their organic matter, and at both of these places were incrustated with calcareous deposits, in some instances forming a conglomerate. The time required for these last results is not necessarily very great, but the organic matter of bone is destroyed very slowly, and is largely present in those of some of the extinct animals. We have obtained a larger quantity of animal matter from the bones of the Mastodon than from those of the deer at Old Enterprise.

The most trustworthy records are found in the forest trees growing upon the mounds. These give us a minimum age with some approach to accuracy. The live-oaks (*Quercus virens*) are not only long-lived, attaining an age of many centuries, but their wood is the most durable of all the forest trees of the United States. One of these, which had fallen from the effects of age, lies upon the top of a mound in the woods near Blue Spring, and measures five feet and six inches in diameter. As it was on the summit of the mound, it could not have begun to grow until the mound was nearly or quite finished; it *may* have begun many years later. It had been dead for a long time; its bark, all of the small and most of the large branches had disappeared. These trees after they are dead still remain erect for many years. Some

of them girdled more than thirty years since, can still be seen standing firmly in the Indian-old-fields. It certainly would not be extravagant to say that the tree in question had been dead more than half a century. Fragments of pottery were found in the earth and shells contained in the upturned roots of this tree, and on sinking a pit in the place formerly covered by the upright trunk, others were found at a depth of from two to three feet. We had neither the tools nor the aid for making a section of this trunk to count the number of annual rings. Through the kindness of Commodore John Rogers, of the United States Navy, we have received a section from a tree nearly a century and a quarter old, and find that at the beginning of the second century there are about fifteen rings to the inch. In later periods of the life of the tree they would of course be more numerous. Assuming fifteen to the inch as the average, a half diameter of thirty-three inches would give 495 rings, or nearly five hundred years; if to this we add fifty years for the time since the tree died, there can be no doubt that the mound was substantially as complete as now more than a century before the discovery of the country.

We know of no data based on the quantity of materials of which the mounds were formed, on which to estimate the time required to build them; to this end, it would be necessary to know the number of persons occupying the place, and the daily or annual consumption of food. If, as is the case of mounds built up in the swamps, they were resorted to only by those who could find camping conveniences upon them, the number must necessarily have been very small.

The later aborigines had no traditions with regard to these shell-heaps, or the burial-mounds which are sometimes near them. They ascribed them to a former race. Florida, however, has been more than once overrun by exterior tribes, and the absence of traditions might in this way be accounted for, since these would be likely to be lost with the change of inhabitants. Under the most favorable circumstances tradi-

tions form an uncertain basis for history. If, therefore, on the one hand there is no proof of great antiquity, it may still be claimed that there is nothing inconsistent with it, and that the appearances of the mounds, and facts connected with them, largely favor it.

IV. ST. JOHNS BLUFF.

It was the special object of this paper to describe only fresh-water shell-heaps, but as we have visited two deposits consisting of marine species, chiefly oysters, we will add a few words with regard to them, especially the above-mentioned locality. The one at Fernandina, on the northerly end of Amelia Island, has already been described by Dr. Brinton,* who has given the most satisfactory proof of its human origin, and of other similar deposits on the Atlantic and Gulf coasts of Florida. The result of our own observations at Fernandina are confirmatory of what Dr. Brinton has recorded, and afford some additional evidence from the earthworks thrown up during the rebellion, and the mounds over the soldiers' graves in the rear of Old Fernandina, in making both of which, portions of the shell-heaps were uncovered, and the contents, similar to those previously noticed, exposed.

St. Johns Bluff has a twofold interest, for it was not only a favorite resort for the Indians, but was the scene of two of the most tragic events in the early history of the continent. † It is situated on the right bank of the river, and about five miles from the mouth. Like all the adjoining shores, it is composed of a fine yellowish silicious sand. It is about forty feet high on the front, and at the eastern end rises quite

*Floridian Peninsula, p. 177.

† It was here that the French, under Jean Ribault, in 1564, built Fort Caroline with a view to establish a Huguenot colony, which in less than eighteen months Menendez, with the purpose of impeding the progress of Protestantism captured, put the garrison to the sword, and set up the inscription, "not as to Frenchmen, but as to Lutherans." Two years later Dominique de Gourgues avenged the atrocity, by retaking the fort, killing the captives, leaving behind attached to a tree another inscription, "not as to Spaniards or mariners, but as to traitors, robbers, and murderers." See Parkman, *Pioneers of France in the New World*. Boston, 1865, p. 157.

abruptly out of a marsh, and to the westward, *i. e.* up the river, descends at first by a rapid, then a gentle slope, which merges into a nearly level plain, backed by the thickly-wooded hills; beyond this is a marsh, which, still farther to the westward, is bordered by a creek.* The base of the bluff is washed by a swift current at every tide, so that it is constantly undermined, and is rapidly disappearing. Earthworks thrown up on top during the rebellion have already begun to fall. I was told by a man living near by that an oleander tree, which I saw lying at the water's edge to the westward of the bluff, a few years since was thirty feet from the shore in the middle of a garden.

At present the bluff itself must greatly differ from what it was when the French came, and it is highly probable that more of it has been destroyed than remains. The site of Fort Caroline has not been identified, and has probably disappeared. The bluff presents a front of clear sand, is overgrown with trees except where military works were thrown up, and beneath the vegetable mould, a few inches thick, is a layer of oyster shells, with a very slight admixture of sand, extending from two to three hundred feet along the more easterly portion, and varying in thickness from a few inches to three feet. A second and much thinner layer is seen to the westward, where the land rises only eight or ten feet above the water. It is not improbable that the two deposits were originally connected, the intervening portion having been washed away. Fragments of pottery which have fallen from the banks are scattered along the whole shore in front of these deposits, and on examining fresh sections made by the falling of the bluff, and also in making excavations in undisturbed portions, similar fragments were found in place, and so there can be no doubt that the shells and pottery were simultaneously deposited. After careful search no flint or other implements were found during my visit, either

*Mr. Parkman's description of St. Johns Bluff, in the work already cited, is admirable for its portrayal of the general landscape as well as the individual details.

in the bluff itself or along the shore, neither were the bones of edible animals found mingled with the shells. Flint implements have, however, been obtained in considerable numbers, and an arrow-head was given me by a negro, who had picked it up near by. The various excavations for military purposes, revealed the existence of shells several hundred feet to the rear of the present front of the bluff, and beyond the creek to the westward of the marsh is a farm, where pottery and shells may be seen loosely scattered over a tract of many acres in extent, wherever the plough has turned up the soil.

The shell-mounds of the sea-coast, as well as of the interior, seem to have passed almost unnoticed by the early writers on Florida. Dr. Brinton quotes a single passage, the only one met with by him relating to the subject, from Cabeza de Vaca, in which it is stated that the houses of the Indians were "built of mats on heaps of oyster shells."*

ENUMERATION OF THE SHELL-HEAPS VISITED.

Besides those mentioned in the following list, there are many others not visited by the writer, some of which are said to be of even longer dimensions than any seen by him.

The localities are mentioned in the order in which they stand on the river, beginning with those nearest the sources.

1. Rattlesnake Hammock, on Salt Creek, right bank, and near the union of the creek and the St. Johns.

2. Solee's Landing, right shore of Lake Harney.

3. King Phillip's-town, left bank of the St. Johns, a mile below the outlet of Lake Harney. There is a large burial-mound near this locality.

4. Another shell-heap, one mile below preceding.

5. Watson's Landing, right bank between Lakes Harney and Jessup.

6. A mound one mile above preceding, on the same side of the river.

7. Black Hammock, left bank, just above the outlet of Lake Jessup. There is a small burial-mound here.

8 & 9. Two mounds on the right bank and below the preceding, but separated from the river by a large lagoon.

10. Spear's Landing, about five miles above Lake Munroe, left bank. There is a burial-mound at this place.

11. Buzzard's Roost, left bank, near entrance to Lake Munroe.

12. Doctor's Island, right shore of Lake Munroe, above Enterprise.

*Floridian Peninsula, p. 179.

13. Old Enterprise, right shore of Lake Munroe.

14. Outlet of Lake Munroe, right bank.

15. Wekiva, right bank.

16. Blue Spring, right bank.

17 & 18. Two mounds in the woods below Blue Spring, with a wide swamp between them and the river. A third but small mound was found about a half mile from them.

19. Mound above Hawkinsville, left bank formerly, and still ought to be called Osceola, or, as Dr. Brinton writes the name, Ass-se-he-ho-la, Rising Sun, after the celebrated chief who was prominent in the Florida War.

20. Mound below preceding, left bank, having the usual appearance of the other shell-heaps, but in which we failed to find signs of its artificial origin.

21. Old Town, left bank, seven miles below Hawkinsville.

22. Small mound in the woods in the rear of the preceding.

23. Mound above the outlet of Lake Dexter, left bank.

24. Mound below the outlet of Lake Dexter, right bank.

25. Fort Butler, left bank.

26. Volusia, right bank.

27. Rope's Island, right bank, entrance of Lake George.

28. Drayton's Island, now Rembrandt's Island, at the outlet of Lake George, left bank.

29. Horse Landing, right bank, eight miles above Palatka.

30. Palatka, left bank, one hundred miles from the mouth of the river.

31. St. John's Bluff, right bank, five miles from the mouth of the river.

32. Old and New Fernandina, at the northern end of Amelia Island.

THE POTATO-MOULD.

BY JOHN L. RUSSELL.

MOULD and mouldiness are two words with which every one is familiar, but few are aware how numerous and diversified are the forms under which the little plants these words designate occur, and to what extent is the mischief they occasion, or know much of the utility in the plan of nature they sustain.

The science of botany as such does not date back very far, and in its place and prior to its existence, all vegetable growth was regarded with a superstitious, and in most cases

with an useless reverence, containing as was supposed some rare power in healing, or some efficacy in incantations and magic.

With regard to the moulds, it was Micheli, who in 1729 published his *Nova Plantarum Genera*, that established the scientific character of the genus *Botrytis*, on which since, from certain structural differences in the mode of producing the seed, other genera or distinct kinds of mould have been constructed. Of these, Corda instituted the genus *Peronospora*; the minute moulds which belong to it, and they are numerous, infesting only living plants. The discovery that their presence caused injurious effects and even great loss is of modern date, and to the investigations of Professor Caspary of Bonn, the botanist and the agriculturist alike are indebted for the valuable knowledge.

The words "mould and mouldiness," familiar as they are, are now significant of topics interesting to the farmer, and by them he is annually subjected to the loss of his cabbages, clover, lettuce, onions, parsnips, peas, potatoes, etc.

To the common eye, and unaided by science, mildews, mouldiness, and similar microscopic plants, would be readily confounded. But the mildew is a much more highly developed fungus, and though apparently as dangerous, is not so to the same extent. The egg-like mould (*Oidium*) which covers and suffocates the young gooseberry or the grape, readily yields to agents which will destroy it, and set free from its threads the swelling fruit; but the potato-mould for instance, is the inception of the potato-rot, which is so dreaded.

The "moulds," then, are fearful parasitic plants, which riot on the tender tissues of other plants, and eventually cause their death. It is estimated that in Europe no less than ten different kinds of fungi are known as infesting the potato, and probably the number in this country is no less. It is on this account that those who have attempted to describe the potato disease among us, have differed so widely from

each other; and while each has thought the other wrong, all have attained some approximation to the truth.

The potato-mould is the *Peronospora infestans* Caspary, and were it not for its effects, would be regarded by every one of taste as a beautiful object. Were we flies or insects, which are so liberally endowed with sight and eyes, and quite unconcerned about the crops, the leaves of the potatoes would be quite a pretty set of objects to investigate, presenting handsome, white, many-branched and beaded-twigged plants, with oval or egg-shaped seed-bodies on the tips of each smaller branch. These vegetable growths issue from the breathing pores of the leaves, and besides feeding themselves on the nutriment intended for the leaves, choke up the internal and external passages and prevent the healthy action from being maintained. Soon the leaves become at first paler, or yellow, then discolored spots appear, then the stems are spotted with dark patches. Even the cellular tissue (or pulpy part of the stems or stalks, "potato-stalks" as we call them) is discolored and filled with dark clotted substances: subsequently, sooner or later, the stalks putrify, the skin separates from the harder or woody portions; next the tubers suffer, spots and decay appear in a more or less regular manner of concentric lines, the skin withers, a white mouldiness often occurs, especially if the potatoes lie in a moist place; the "rot" increases with fearful rapidity, the tuber has a disgusting odor, certain smaller insects help the process at this stage, and putrescence closes the scene.

A plant thus simple in its general structure, and capable of bearing on its rapidly growing branches three thousand two hundred and seventy (3,270) seed-like pods, each containing at least six seed-like bodies (*zoöspores*) on one square line of the under surface of the leaves, and from each of which in turn a perfect seed-bearing "mould" is produced in eighteen hours, may be readily conceived to be capable, minute as it is, of incalculable mischief. The reader may, however, calculate by reduction to fractions of an inch, the

size of one of the seed-vessels (*acrospere*) containing these six or more seeds, when Professor Caspary computes its breadth at $\frac{1}{165}$ of a millimetre, and its length at $\frac{1}{125}$ of a millimetre (*Monatsberichte der Königl. Akademie*, etc., für Mai, 1855). Seeds, so minute, can be readily absorbed by the roots or even by the leaves, and in such abundance that the very atmosphere may be surcharged with them. A few of them placed in a drop of water and applied to the leaves, stems and tubers, by Dr. DeBary, produced in a short time brown spots, and eventually the disease.

The remedy or the prevention, what? Perhaps none as yet discovered which will be effectual, but the entire destruction by fire of all infected stalks and potatoes looks to a suggestive prevention.

DEER AND DEER-HUNTING IN TEXAS.

BY CHARLES WRIGHT.

IN the States east of the Mississippi river, the number of persons who have seen deer in the wild state is comparatively small, and they are exceedingly few who, by personal experience, have learned much of their ways. And, as these animals are fast disappearing, so also are they who have had the opportunity of studying their habits in their native haunts. Hence, it seems not inappropriate to put on record such information as I have gained, partly from personal experience, and partly from others who have had far more and better opportunities of knowing them well.

The deer is by nature a timid animal, and persecution makes it more so. Even the gentlest pet that will take food from the hand or lick the fingers will not suffer that hand upon the back without shrinking. Of the very different degrees of domesticity to which animals attain, that of the deer is among the lowest. According to the frequency and

the manner in which he is hunted, so is his cautiousness increased. If he is chased, the voice of the dog, though at a distance, rouses him from repose to seek safety in flight. When hunted by men on foot, as in the Indian country, he becomes wary of footmen, but will allow a rider to approach him quite closely. Just the reverse takes place when the ordinary mode of hunting is on horseback. It is also a prevalent belief that, where Indians are the principal hunters, he learns the difference, and becomes comparatively fearless of a white man. This is akin to the notion that the crow can distinguish a man with a gun from one who has only a stick, though it may resemble a gun.

The old bucks consort together most of the year; the does and young bucks go in herds by themselves. When the does have their fawns in the spring, they separate from the young males, and from each other, and remain for some months with no companion but the fawn, until it is pretty well grown. If a fawn, quite young, be met by a man on horseback, it will follow the horse as if it were its mother. One caught within the first few days after its birth becomes quite tame in an hour or two, and makes no effort, afterwards, to escape. Yet, it never becomes domesticated like the dog or cat; and, though it will stay in and around the house, and among the cattle, dogs and people, it runs away to the woods within two or three years.

Deer are very silent animals. Only two sounds that can perhaps be called vocal have been heard by me. One is a cry of terror or of pain. The fawn, when caught, bleats like a lamb or kid in like circumstances, and the grown deer, when the backbone is hit by the bullet, falls in its tracks and often emits a similar cry of pain, or it may be of terror, for it is sometimes repeated when he is seized by the hunter, or even when the latter is seen approaching.

Another sound is a kind of snort,—a forcible emission of air from the nostrils. The hunter says he "blows;" it may be a note of anger or defiance. At the season when the doe

is rearing her young, if she is surprised near the fawn, and yet if the danger be not very imminent, she will stand and "blow," occasionally raising a forefoot and stamping with it on the ground. The bucks also blow, but less frequently.

If my memory does not deceive me I think I have heard the hunters speak of other sounds made by deer,—a faint call of the mother to the fawn, and the reciprocal cry of the young. There may be also a sexual call. I think I have heard such an one spoken of, as uttered at the time when the males seek the females.

The hair is shed twice in the year. The summer-coat is red; not exactly the color of a red cow nor that of a bay horse, yet not very unlike either. The fawn is similar in color, with two rows of white spots, and scattering ones on each side, which it retains often long after the winter-coat is assumed. This is called the blue. It is rather an ashy-gray, or near a slate-color. The hairs are longer, much closer, whitish, except the tips which are dark, or ringed with white and dark spaces.

It is a current belief that deer feed principally on grass. This is far from being correct. They love what is tender and juicy. They resort always to a recent burn, when grass and weeds are just shooting again and are soft; then abandon it for a newer one, so soon as the plants have become hard or tough. If the track of deer be followed, the grass will never be found cropped by the mouthful, as it is eaten by horses, cows, and sheep. Deer select here only a blade or two, there a tender twig or leaf; but they are fond of fruits of almost every kind. In early spring they visit the ponds in which the May-haw grows, the fruit of which is juicy with the flavor of the apple, though too, sour. Later they resort to huckleberry bushes, grape-vines, and persimmon trees, and finally to the oaks. All kinds of acorns, but especially those of the annual trees or sweet acorns, are greedily eaten by them; also chinquapins: and where chestnuts and deer are found together, doubtless the former yield food to the latter.

They sometimes trespass on cornfields, where they crop the bean-vines if there are any, but I am not aware that they injure the corn.

The bucks shed their horns late in the winter. I have heard it affirmed that they pull them off with their feet, when the time arrives that they should be shed. It is quite probable, too, that they may be pulled off when running through thickets. They are sometimes observed at this season with but one antler. It is reasonable to suppose, also, that they may be thrown off by a violent shake of the head when nearly ready to fall, particularly where there are no bushes, as in the great prairies. They soon begin to grow anew, increasing rapidly, and at first they are flexible and covered with soft hair. In this stage they are said to be "in the velvet." In August they have become fully formed; and at, or before this time, they rub their horns against bushes to rid them of the velvet. I have often seen bushes stripped of their bark at a later season, and I conjecture that the practice is connected with the sexual passion. Another custom I am quite confident is due to this cause. They stand under the spreading branch of a tree, which may be about at the height of the animal's head, and paw away with the feet all the leaves and weeds, or herbs if there be any, making a bare spot of ground two or three feet in diameter. This is done only at the period when the buck runs the doe. It is said that bucks will run a castrated individual of their own sex as they do the doe. The place is visited either by different animals from time to time, or some one deer returns repeatedly to the same spot to scrape anew. Whether it is done by one or both sexes I do not know. It is, probably, analogous to the habit of the bear when he barks a pine tree. The second year the antler of the buck is a simple spike; and, according to the general belief, a branch is added each year for five or six years, after which there is rarely any increase in the number of points. I killed a buck with one antler normally formed,

the other smaller, in an atrophied state, and so soft as to be easily broken.

What becomes of deer's horns? A few years ago I saw an attempt to answer the question by some person in one of the Southern Atlantic States, and he arrived at the conclusion that the animal covers them or they would be oftener found. But, in the first place, deer are not so plentiful there that they must be expected to scatter their horns very thickly over the open parts of the forest where they would be readily seen. And, again, each large buck has but two horns thus to dispose of each year; and the large bucks are not very numerous, while the antlers of the small ones are inconspicuous. But the writer had, or thought he had, evidence that the buck covers his antlers with leaves. Doubtless they are so covered by leaves which fall upon them, according to natural laws; but in the forests, and particularly in the prairies of the west, I have seen hundreds which certainly had never been covered by the animals that dropped them. They decay in the ordinary course of nature, and are also eaten by some small rodent, whose tooth-marks I have often seen upon them.

It may not be known to many that bucks often "lock horns," and it sometimes becomes a "dead-lock," literally. I have met, during my hunts, more than one pair of heads thus coupled together, and I killed one pair of bucks so firmly united, that they would have died of hunger if I had not put them to death in a manner less lingering and painful. These animals had evidently come together with great violence; the antlers had yielded to the shock, and had closed again in such a manner that no ordinary exertion of strength was sufficient to separate them. It is not very easy to explain their position; but the beam of the left antler of one was behind, and in close contact with the bases of the two antlers of the other, while the tips of the right antler of the former were locked in the tips of those of the latter. When, later, the skin on the back of the head at the base of the

antlers dried and shrunk, room was made for a little movement, and they could then be unlocked.

At the close of summer the does have become lean,—the effect of rearing the fawn,—while the bucks are in prime condition. Then begins the running season, when the bucks grow careless, or fearless, or both, and fall an easy prey to the hunter. The does, too, seem less wary, or are more intent on feeding. They improve rapidly in condition, especially if mast is plentiful, becoming before midwinter fully fat. The bucks, in their turn, become lean and big-necked, and the flesh acquires a rank taste, so as to be quite unfit for food except under the influence of extreme hunger.

The deer's three senses,—sight, hearing and smell,—are neither of them, by itself, quite adequate to advise him of danger. A noise excites his attention and calls in vision to discover the cause, yet both together may not insure his safety, if danger be near. The noise may be made by the leaping of a squirrel or the scratching of a bird among the leaves; or, it may be any other of the thousand notes that a listener can hear in the *silent* woods. If alarmed by any of these, he recovers confidence when apprized of the cause.

The sense of vision seems to be imperfect in this particular; it takes no cognizance of form and little of color, unless the form and color be those which come most naturally within the sphere of its recognition,—those of its own species. It is motion that draws its attention. When sitting quite still a deer has approached within a few feet of me, and walked quietly away again, unaware, although I was in plain view all the time, that it was so close to one who might have been its enemy. But when a deer *smells* danger, it needs not to look nor to listen. Hence, the attempt to approach him is useless when the wind is blowing from the hunter towards him. But this sense is the least valuable when he is to windward. Acting, then, on his knowledge of these faculties of the animal to discern danger, and their limitation, the hunter, by advancing *against* the wind, or at

least, *not with it*, has nothing to fear from this sense, and has only to deceive the other two. He learns to walk in almost perfect silence, and if he can avoid being seen, his point is gained. Upon a single deer the approach is comparatively easy. He is generally walking slowly, and now and then putting down his head to crop something. In this latter case he cannot see an approaching object; but the moment he raises his head to look about (which he does as often as every half minute or thereabouts), the hunter stops and remains quite still. The deer, at every movement it makes, putting down or raising its head, shakes its tail. Knowing this, the hunter knows just when to advance and when to stop. Thus observant of every motion of the animal, he makes an approach, of which it is quite unaware; and, should it at length perceive the final movement,—the preparation to fire,—it does not immediately run away, but waits a little to see what is the matter. When two deer are together, it is more difficult to come near them, as they may not both feed at the same moments, unless by accident; and the difficulty is increased just in proportion as the number of the herd is greater; and when there are several together, it is nearly useless to attempt to come within gunshot, but better to go away and look for a smaller herd. This is the mode of hunting where, as in prairies, there is no means of concealment. In woods the hunter advances under cover of trees or bushes.

The best hour for hunting is the first clear daylight of the morning. Just before night again, deer are generally feeding. In the summer time they will get up at any hour of the day if a shower comes on. When flies or mosquitoes are very numerous they keep within the thickets by day, and feed almost entirely by night. At such times, fire-hunting may take the place of still-hunting. It is generally known that when dogs, cattle, horses, and many other animals look at a bright light by night, the rays are reflected; and, to any one in the line passing from their eyes through

the light, they look like balls of fire. Deer will, oftentimes, suffer the hunter, with a light, to come very near them. An old frying-pan, having its flat bottom replaced by some curved iron hoop, serves to hold the pieces of resinous pine. The handle is fastened to a strip of plank which is borne on the shoulder. The deer gazes at the light and sees nothing of the hunter who is between it and the fire. Generally, deer can be approached more closely by night than by day. The aim is at the eyes, or straight below them so as to break the neck; or the body is often seen, so that the hunter can shoot where he pleases. A deer rarely falls, when shot, where it was standing, but generally dashes away fifty to a hundred paces or more, even if shot through the heart. If he raises his tail,—shows the white feather,—it may be suspected he was not hit. If struck by the bullet, he runs off at his utmost speed with the tail pressed close down. In the daytime, the hunter goes where the deer was standing, which may be known by the deep tracks made at the first spring, and looks for hair cut off by the bullet. If he finds it, he is sure of having hit his game; and following on the track, he soon comes upon the blood, when he can track it more easily. This is where there are bushes or tall grass. In more open places, the deer may be seen to run its race and fall dead. If any part of the spinal column be touched, the animal falls where it is standing, but if the bone be only slightly hurt it may get up again. I have had a case or two of this kind, when, just as I was about to bag my game, he has jumped up and taken leg-bail.

This account of the deer will hardly be complete without some remarks on the chase, and of this I know nothing by personal experience; but there is no lack of narratives and incidents relating to this gentlemanly and royal sport. So I will only touch upon one peculiarity of the chase in Texas, as I heard it from those who had followed it in the states from which they came. It was said, that in the Atlantic and Gulf States, where the chase is, or was, a favorite pastime,

the hunter can judge, with considerable probability, where the deer will pass when running before the hounds. Thus in a given area,—a township we will suppose,—the deer will cross a creek in one or two of half a dozen regular crossings; or he will pass one of a limited number of known glades or openings in the general forest. But in Texas this did not hold good. Either the deer had no regular passing places, or they had so indefinite a number that the hunters were not able to discover them. Perhaps this difference comes from the fact, that running deer with hounds had never been practised there, and they had not become used to it. The hunters were quite at a loss where to station themselves in order to get a shot at the chase.

It may not be irrelevant to describe the process of dressing deer-skins, which furnish the material used in the manufacture of buckskin gloves. There are three principal operations: graining, braining, and smoking. The first is mechanical; the other two effect some chemical change which I am unable to explain satisfactorily. The skin is dried and afterwards soaked till it is soft; then the hair and grain, or cuticle, are rubbed off with any instrument serving the same purpose as a currier's knife, the skin being spread out on anything answering to the currier's beam. The skin is partially "broken" in this process, and it should be stretched and broken still more, while drying, that it may "take brains" more readily. The brains of the deer, or any similar quantity of another animal will dress the skin.* These are thoroughly dissolved in a half pailful of warm water. The skin, immersed in it, soon absorbs the brains and becomes thick and spongy. It should be stretched in all directions, carefully, that no spot may be left unaffected, otherwise that spot will remain hard. It is known when the skin is brained in this manner. Gather up a fold of the

* The same effect is produced by saturating the skin in oil, and then washing it out with strong soap and water. The bruised or crushed root of *Yucca filamentosa* is also used; and the seeds of *Sapindus saponaria* (soap berry) would, probably, answer the same purpose.

skin into the form of a sack or bladder, and blow into it or inflate it; then, closing the orifice and pressing upon the sack, the included air will pass out through innumerable pores, making a spray from the particles of contained water. Wring out all the water possible, and stretch and rub it as before, while drying, when it will become white and soft. If stretched in a suitable frame, nearly to its natural shape, and rubbed with a wedge-shaped stick, the labor is less and the skin is smooth and even; otherwise it will remain more or less wrinkled,—some parts unduly, others not sufficiently stretched. But if the skin be now wetted and suffered to dry without manipulation, it becomes hard again like rawhide. Smoking is a means of obviating this. The object is to make the smoke pass through the pores of the skin. The effect of the braining seems to be to comminute the gluten, but it does not affect its solubility. The smoke seems to form a chemical combination with it, rendering it insoluble. Any dry rotten wood,—hickory, ash, oak, or even cobs,—serves to make the smoke. A hole is dug in the ground about two feet deep and six inches in diameter. Some coals are thrown in and a little of the wood upon them. The skins (better two together) are loosely sewed along the edges, except one, which is stretched around the hole, and the skins are then suspended above it, much like an empty sack with the mouth downward. The smoke in its ascent fills the sack and passes through or penetrates its substance. The process is kept up till the operator deems the skin sufficiently smoked. Now, if they are wetted, they dry soft without manipulation. There is still an operation which improves them, though not necessary. It is a species of tanning. Willow-bark, or that of sassafras is good, as it does not stain clothing, which is spotted by the ooze of oak when the skin is wet and comes in contact with it. We boil a small quantity of bark, and dip the skins into the ooze for a few minutes; wring them as dry as possible and the operation is finished. Treated in this way, the skin becomes one of the strongest textures we

know of. But in its original state, a skin of ordinary size is easily torn into strips. When dressed, the fibres being loose, come gradually into parallelism, and the tension is resisted by many at once. Previously, held to its place by the gluten, each fibre, acting singly, was readily broken.

Here is a problem for hunters. *With a single bullet, to shoot a deer through the heart and break both fore legs, one of them just above the foot.* It has been solved. But how?

THE HABITS OF SPIDERS.

BY J. H. EMERTON.

EVERY reader of the NATURALIST has noticed the round, regularly formed spider-webs which often adorn the corners of fences, and the windows of neglected buildings; but few, perhaps, have had time or patience to watch the skilful manner in which they are constructed, or to examine the apparatus by which the spider spins the thread out of her own body. The builders of these webs belong to a large family of spiders, the Epëiridæ. They are found in all parts of the world where winged insects, which form their food, abound.

To illustrate the habits and structure of these spiders, we will select one common species as a representative of the whole group, and confine our observations to it. This species, the *Epëira vulgaris* of Hentz, seems to be common all over the United States, and is represented by closely related species in other countries. It is seldom found in the woods and fields, but lives in great numbers on garden fences and trellises; in barns, and on the framework of bridges, the structure of which affords numerous crevices for shelter and concealment. When fully grown it is half an inch in length, and its feet, when extended, will cover a circle an inch and a half in diameter. It is clothed with hair of a greyish

color, the back is ornamented with various whitish markings, and the legs with rings of black and yellow. The under side of the body is black, with yellow markings. In sheltered places they spend most of the time in their webs waiting for prey, while in situations exposed to the sun and wind they watch only in the night. During the day, and in stormy weather, they remain concealed in some crack or corner, near which, for convenience, the web is always placed. In such retreats they also pass the winter without food, and only covered by a thin web of their own spinning. Like other spiders they are furnished with poisonous jaws, which they attempt to use when disturbed, but as they can only bite what comes directly between their jaws, they may be handled without fear. There are but few cases on record of a spider biting the human skin. Their timid nature leads them to avoid danger rather than resist it, and the common suspicion with which they are regarded has no foundation, except a want of acquaintance with their habits.

If we take a spider of the kind just described and turn it under side up, as in Pl. 11, fig. 2, we shall at once notice that the body consists of two nearly equal parts, connected by a slender waist. The front part gives origin to the organs of sense and motion, while the hinder part contains the principal internal organs. The most conspicuous appendages of the body are the four pairs of legs (Fig. 2, *a, a, a, a*). Immediately in front of these is another smaller pair (Fig. 2, *b*, and fig. 7), the first joints of which are flattened, so that they may be used as jaws, or lips (Fig. 2, *c*), for squeezing the food. The ends of these last limbs are supposed to be organs of touch, and are called palpi. Next in front is a pair of stout jaws (Fig. 3, *c, c*), each of which is furnished with a sharp claw at the end (Fig. 3, *a*). This claw is hollow, and is pierced with a minute hole near the point (Fig. 3, *b*). When the spider bites, a drop of poison is discharged through this orifice from a gland in the head. This quickly kills insects, and causes inflammation of the bitten part in larger

animals. On the front of the head are the eight eyes, four near together in the centre, and a pair on each side (Fig. 3).

The feet of spiders are wonderfully adapted for walking on the web. Each foot is furnished with three claws (Fig 6, *a*, *b*, *b*), the middle one of which (*a*) is bent over at the end, forming a long finger for clinging to the web, or for guiding the thread in spinning. The outer claws (*e*, *e*) are curved and toothed like a comb. Opposite the claws are several stiff hairs (Fig. 6, *c*) which are toothed like the claws, and serve as a thumb for the latter to shut against.

The spinning organs are three pairs of fleshy appendages situated at the posterior end of the body (Fig. 2, *e*). When not in use they are folded in towards each other, the third pair covering the second. When expanded, they appear as in Fig. 4. The end of each of these spinners (*s*, *s*) is covered with minute jointed tubes, like Fig. 5, which represents one tube much enlarged. Inside the spider, and connected with the spinners are several bunches of glands, which secrete a liquid like the white of an egg. To form the thread this liquid is drawn through the tubes, which divide it into such small fibres that it dries almost immediately on coming in contact with the air. The spider has the power of uniting these fibres into one or several threads, according to the purpose for which they are to be used. The thread commonly used for the web is composed of hundreds of simple fibres, each spun through a separate tube. As the thread runs from the body, it is guided by the hind feet, which hold it off from contact with surrounding objects, until the desired point is reached, when a touch of the spinners fastens it securely.

When a spider wishes to build a web she usually selects a corner, so that the structure may be attached on several sides. She then runs a few threads along the objects to which the web is to be fastened, to facilitate her passage from point to point. The web is commenced by a line or two across the point where the centre is to be, which is not usually the geometric centre, but nearer the top than the

bottom. Radiating lines (Pl. 11, fig. 1, *b, b, b*) are then spun from the centre in all directions. In doing this the spider often crosses from one side of the web to the opposite, so that the finished portion is always tightly drawn, and the tension of the completed web is the same in every part.

Having finished the framework, the spider begins near the centre and spins a thread (Fig 1, *c, c, c*), spirally, around the web to the circumference, fastening it to each radius as it crosses. The distance between the spirals varies with the size of the spiders, being about as far as they can reach. This spiral thread serves to keep the parts of the web in place during the rest of the process, and is removed as fast as the web is finished. It also furnishes a ready means of crossing from one radius to another where they are farthest apart. All the thread spun up to this stage of the process is smooth when dry, and will not adhere if touched with a smooth object.

The spider having thus formed the web, begins to put in the final circles at the outside, walking around on the scaffolding previously prepared, which she gradually destroys as she proceeds, until in the finished web only a few turns in the centre are left. The thread of the circles last spun is covered with viscid globules, strung upon it like beads at short distances. If an insect comes in contact with the thread, it immediately adheres, and its struggles only bring a larger part of its body into contact with the web. Dust and seeds also stick to the web, so that in a single day it is often so clogged as to be of no farther use. The web also becomes torn by the struggles of the prey, and by wind and ruin, so that it requires repair or renewal every night. In mending a web the spider usually removes all except the outside threads, biting them off and rolling them into a hard ball between her jaws, so that when released it will drop quickly to the ground. This probably gave rise to the opinion, sometimes advanced, that the old web is eaten by the spider.

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The spider having thus formed the web, begins to put in the final circles at the outside, walking around on the scaffolding previously prepared, which she gradually destroys as she proceeds, until in the finished web only a few turns in the centre are left. The thread of the circles last spun is covered with viscid globules, strung upon it like beads at short distances. If an insect comes in contact with the thread, it immediately adheres, and its struggles only bring a larger part of its body into contact with the web. Dust and seeds also stick to the web, so that in a single day it is often so clogged as to be of no farther use. The web also becomes torn by the struggles of the prey, and by wind and rain, so that it requires repair or renewal every night. In mending a web the spider usually removes all except the outside threads, biting them off and rolling them into a hard ball between her jaws, so that when released it will drop quickly to the ground. This probably gave rise to the opinion, sometimes advanced, that the old web is eaten by the spider.

When the web is finished she stations herself in the centre, where a small circle is left free of the adhesive threads.

Her usual position is head downward, with each foot on one of the radii of the web, and the spinners ready to fasten themselves by a thread at the least alarm. She often remains in her hole with one foot out, and resting on a tight thread connected with the centre of the web, so that any vibration is quickly detected. If the web be gently touched the spider will rush into the centre, and face towards the disturbed part. She will then jerk smartly several of the radii leading in that direction, to see if the intruder is a living animal. If this test is followed by the expected struggle she runs out towards the victim, stepping as little as possible on the adhesive threads, seizes it in her jaws, and as soon as it begins to feel the effects of the bite, envelops it in a silken covering, and hangs it up to suck at her leisure. In spinning this envelope the insect is held and turned around mainly by the short third pair of feet, while a flat band of threads is drawn from the spinners by the hind pair working alternately like the hands in pulling a rope, and wound over it in every direction, so that in a few seconds it is so covered as to be unable to move a limb. When a web is shaken by the wind, the spider will sometimes draw in all her feet toward her body, thereby tightening the web in every direction so that the vibration is prevented.

The construction of nets for catching food is not the only use of the thread made by these spiders. They seldom move from place to place without spinning a line after them as they go. They are able by its use to drop safely from any height, and when suspended by it are carried by the wind across wide spaces without any exertion on their part, except to let out the thread. The crevices in which they pass the winter, and the leisure hours of summer, are partly lined and enclosed by a coating of silk resembling that used for confining captured insects. The eggs are enclosed in a cocoon of the same material, and there the young remain until they are strong enough to shift for themselves, growing to nearly double their size without apparent nourishment.

— THE —
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EMERTON ON THE SPIDER.

Several hundred young are produced by a single female, but probably it is seldom that one-tenth of this number ever reach adult size. Nearly all the spiders which we see in webs are females, or young. They spend most of their time in the vicinity of their webs, and many doubtless pass their lives within a few yards of the place of their birth. The adult males are seldom seen building or occupying webs: they remain concealed during the day, and at night wander about from web to web. When young, there is no obvious difference between the sexes, but as the time for the last moult approaches, the ends of the palpi of the male swell to several times their former size. When the time for the final moult arrives, both sexes retire to their holes and cast off the skins of their entire bodies, even to the claws. This process obliges them to remain concealed until the new skin has acquired sufficient strength and firmness, when they again return to their webs. The females still resemble the young, except in size, but the males are distinguished from them by the greater length of their limbs, the diminished size of the posterior half of the body, and the large and complicated joints at the ends of the palpi (Pl. 11, fig. 8). The females of some species of spiders are said to devour the males whenever opportunity offers, but we have never noticed that habit in this species, though we have often seen a female charge upon an intruding male, and chase him from her web.

EXPLANATION OF PLATE XI.

Fig. 1. Circular web; one-fourth the natural size.

Fig. 2. *Epeira vulgaris* Hentz. natural size, under side; *a*, legs; *b*, palpi; *c*, jaws; *e*, spinners.

Fig. 3. Front view of head, showing eyes and jaws; *a*, tooth on the end of jaw; *b*, orifice for the discharge of poison.

Fig. 4. Spinnerets spread apart for use, showing the cluster of tubes on the end of each, enlarged twenty-five diameters.

Fig. 5. One spinning tube, still more enlarged.

Fig. 6. Foot; *a*, the middle claw; *b*, *b*, the two outer claws; *c*, toothed hairs.

Fig. 7. Palpus of female or young.

Fig. 8. Palpus of adult male.

dages of the genus *Atrypa*, by R. P. Whitfield. Professor Hall's contributions to Palaeontology include a compendious extract from his work on the Graptolites (Decade ii, of the Canadian Geological Survey), extracts from Vol. 4 of the Palaeontology of New York, and observations on the Niagara limestone of Wisconsin and Illinois. The extracts are principally notices of the generic characteristics of the Devonian genera, filled with facts of the greatest value to the student of this group, and the observations trace the relation of the Niagara group, of New York, to the Guelph limestone of Canada, and the limestones of Racine and Le Claire in Wisconsin, which are said to be identical with a thin bed of limestone in Wayne county, New York, formerly referred to the Onondaga Salt Group. The lithographer has not, apparently, done full justice to Mr. Whitfield's masterly drawings, but all the plates are good, and some deserve high praise.

NATURAL HISTORY MISCELLANY.

BOTANY.

VARIATION IN WILD PLANTS.—Cultivation gets more credit for producing variation in species than I think it is fairly entitled to. The production of double flowers is especially referred to the gardener's art. I think this is rarely the case. Double Buttercups (*Ranunculus acris*, *R. bulbosa*, and *R. ficaria* all have double forms) could scarcely result from cultivation, as they are too common to be ever a cultivated plant. Yet we rarely see any tendency in this direction in wild plants. The only one I ever found double was a *Saxifraga Virginensis*, in a shady wood on the Wissanickon, some fifteen years ago. It was transplanted to my garden, but destroyed the same season by a careless laborer. Has any other double flower been found?—T. MEEHAN.

Saxifraga Virginensis was found full-double at Danvers, Mass., three years ago, and it continues so from year to year. It is well worthy of the florist's attention. Incipient doubling is not uncommon in a considerable number of wild flowers; but the process of doubling is doubtless accelerated under the conditions which attend cultivation.—A. GRAY.

ZOOLOGY.

THE MCNIEL EXPEDITION TO CENTRAL AMERICA.—In May last, Mr. J. A. McNiel, an enthusiastic and ardent naturalist and indefatigable collector, started on his expedition, under the immediate auspices and direction of the Peabody Academy of Science. Arriving at Panama he was cordially received, and aided by the officers of the Panama Railroad and

Pacific Steamship Company, who gave him much desirable information, and helped him in his work in every way in their power. To William Nelson, Esq., Commercial Agent at Panama, he is much indebted for assistance received; and from Captain Dow (who is well known as an ardent lover of Natural History, and who has sent many rarities to various museums) he received marked attention and kindly aid; and Captain Douglass of the steamer Guatemala, and his officers, were most courteous to him during his trip from Panama to the port of Corinto (formerly Realejo), Nicaragua, at which place he made his first collections. He here had the good fortune to meet with Captain Emmons, of the U. S. sloop of war Ossipee, who, with his officers, kindly assisted him in his marine collecting. After a stay of a few weeks at this place, Mr. McNiel went into the interior and collected for about a month on and near the Rio Gigillillo, where he was most hospitably entertained by Don Ycidro Ycaza. He here collected a large number of insects, comprising about 3,000 butterflies, which were packed in papers, and large quantities of other orders in alcohol; together with about 1,500 unios, and about a bushel of various species of land and fresh-water gasteropods, with many other species of various classes. He then returned to the coast to forward his specimens to the Academy, where they have arrived in safety. At the date of his last letter he was on the eve of departure for the interior again.

We take great pleasure in making this public acknowledgment of the uniform assistance and courtesy extended to Mr. McNiel by the various gentlemen whom he met, as it is most gratifying to the naturalist to feel that he is every day meeting more and more with the sympathy and encouragement of educated men, and that the dark days of science, when a naturalist was looked upon as a person a little out of his proper mind who spent his time "Bug-hunting," is now buried in the past, and that henceforth a man can run after a butterfly, or bespatter himself with mud, in his attempts to obtain some desired inhabitant of the ditch, without feeling that he is looked upon by his fellow-men as a "natural" instead of a naturalist.

It is the intention of Mr. McNiel to spend about two years collecting in Central and the northern part of South America, and from the way in which he has commenced, we feel sure that science will be largely indebted to him for much that is new and important from that most interesting region.

As there are no funds of the Academy that can be devoted to such an expedition, we shall have to depend upon the liberality of the friends of science, and the sale of part of the specimens for its maintenance. On the receipt of specimens at the Academy they will be at once arranged, and after selecting a series for the "McNiel Collection" of the Academy, the rest will be offered for sale, and special investigators can secure the specimens relating to their departments, by addressing the Director of the Academy. Donations in aid of the expedition are also solicited. Any party aiding the expedition will receive an equivalent in specimens if

desired, as well as the thanks of the Academy. We shall from time to time call attention in the NATURALIST to the progress and results of this expedition.—F. W. PUTNAM, *Director, Peabody Academy of Science.*

THE SHELLS OF MONTANA. *Helix Townsendiana* Lea.—Numerous small specimens were found in the dry prairie at the junction of Hell Gate and Bitterroot rivers, and as I found larger ones of various sizes in more damp situations of the woods, from an elevation of 4,800 feet down to 2,200, at the west base of the Bitterroot range, I presume this is a dwarfed variety, such as is found also west of the Coast Mountains, in Washington Territory. It is the most wide-spread species I have seen there.

Triodopsis Mulleri Bland & Cpr.—A single dead specimen, of a beautiful semitransparent yellow, resembling *H. tridentata* in size and form. I found here under a stone, and afterwards found in small numbers at the west side of the Bitterroot crossing, forty miles distant.

Helicodiscus? polygyrella Bld. & Cpr.—This beautiful little one-toothed species I found common on the Cœur d'Aléne Mountains, especially their east slope, inhabiting moss and decaying wood in the dampest part of the spruce forests.

Anguispira Cooperi W. J. B.—This fine species I found only on the east slope of the dividing ridge of the Rocky Mountains, at an elevation between 5,500 and 6,000 feet above the sea! From the dryness of the season (Aug. 10) I presume I could find none moving about, and but one alive. Most of them were about the roots of *Geranium incisum*, a species abundant on both slopes, but I looked for Helices in vain in the other.

Anguispira solitaria Say (or *A. Cooperi* var?).—The large globose lipless Helix inhabited both slopes of the Cœur d'Aléne Mountains, above 2,500 feet elevation, preferring the openings in the forest covered with bushes and ferns.

Anguispira strigosa Gould.—I was always on the lookout for Helices, and up to August 31st found none along the Bitterroot river except rarely *H. Townsendiana*. That day, however, at a hill called "Half-way," thirty miles below the junction, I found two additions to the list. The larger, flattened, banded and somewhat carinated form, I found *astivating* under logs of pine on a steep shaly slope containing lime in veins.

Hyalina arborea Say; *Patula striatella* Anth.—Found in damp bottom land along Hell Gate river, about 4,800 feet above the sea, living on decayed logs, etc. Not seen elsewhere.

Lymnaea palustris Linn.; *L. bulimoides* Lea.; *L. desidiosa* Say; *Physa heterostropha* Say.—Missouri river above the falls, about 3,000 feet above the sea. August, 1860.

Lymnaea palustris Linn.; *L. humilis* Say; *Bulinus hyemorum* Linn.; *Physa heterostropha* Linn.—Hell Gate river, west slope of the Rocky Mountains, 4,800 feet above the sea. August 14, 1860.

Planorbis tricoloris Say; *P. parens* Say.—Bitterroot river.

Sphaerium striatinum Linn.; *Unio luteolus* Lamk.; *Margaritana arcuata* Gould.—Missouri river above the falls. Also found in Spokane river, below

Lake Cœur d'Aléne, and at the ferry over that river. They can be seen in the clear water several feet beneath, completely covering the bottom like mussels (*Mytili*) on shoals along the seashore, standing edgewise among the large stones.

Sphaerium occidentale Prime.—Spokane river, September 1860.

Unio Oregonensis Lea?—I saw a few valves in Spokane river, below the upper falls.

Anodonta Kootenaiensis Baird.—Spokane river, below lower falls, on stones, September, 1860; common.—J. G. COOPER, M. D.

HINTS ON OÖLOGY.—In every branch of natural history, collections must be formed and suitably classified to enable the student to compare one specimen with another, and thus secure to science the benefit arising from his speculations. The mere collecting of specimens, it is true, has become one of the least of the objects desired by scientific men, yet in no branch of scientific pursuit is there more need of care and accuracy, than in the collection and identification of specimens of natural history. And especially is this true in an oölogical collection, where the identification of each specimen ought to be the main object of the collector.

The easiest and most satisfactory method of identifying a nest of eggs, is by shooting or catching one or both the parent birds to which the nest belongs, but at times this is impossible and other means must be sought. Examine carefully the situation of the nest, of what materials it is composed; notice the locality, what species frequent it, and make a record of these and kindred observations in a note-book. In this manner the true species may often be discovered. The proper method of preserving eggs next invites our attention. Eggs must be emptied of their contents, as they are liable to swell and burst the shell if handled. The most convenient way of effecting this, is to drill two small holes on the side (Fig. 1), and not at each end, as is the more common method. Having done this, apply the mouth or a small blowpipe at the smaller hole, forcing the contents out of the larger. If it contains an embryo, force out as much as possible without breaking the shell, and, with a small glass syringe, partly fill the shell with water and make another attempt. If this is impossible, carefully enlarge the hole, and by means of a sharp penknife and small wire hook, the largest embryo may be successfully removed. The ingenuity of the operator will easily provide means for special difficulties, but in no case should an egg be left partly emptied, as it will immediately attract insects and ruin the specimen. The only instrument absolutely required are small drills and a syringe, though, when convenient, the use of blowpipes and elongated scalpels will be very useful. It is considered a good plan to hold the egg over a basin of water when blowing it, that it may not be injured if it slips from the fingers. Some oölogists preserve the nest of the bird with the eggs, and, when practicable, the parent bird. Eggs should be carefully marked when laid aside, that no mistakes may

Fig. 1.



arise. Different collectors prefer different methods of doing this. Perhaps the best is to mark the egg, on the same side as the holes, with a quill pen. This should be done in neat letters, the name of the species, and the number, referring to the collector's note-book, which should contain full data in respect to the identification, time and place where secured, etc. Both the English and scientific name should be given. Many persons use very fine sawdust to lay their egg on, but this has a tendency to destroy the shells and ruin the specimens. Cotton is very good and is also employed by many. Eggs, when mounted on strips of cardboard, may be preserved in a neat and secure manner. They should be kept beneath a glass-case, free from the rays of the sun, which cause the natural tint or "bloom" to fade and lose its freshness. The student of nature cannot find a more interesting branch of scientific investigation, than that which pertains to those objects which are presented to his vision from day to day. The habits of the birds of North America, and their manner of building their nests and rearing their young, affords an opportunity of careful and minute study. The song-birds of New England are not the least of its many attractions, and the student who will make himself more conversant with their oddities, will find a world of beauty opening before his astonished gaze.—G. R. METCALF.

THE "DWARF THRUSH" AGAIN.—In the NATURALIST, for June of this year, Mr. E. A. Samuels gives a notice of the "Dwarf Thrush (*Turdus nanus*) in Massachusetts," the specimen referred to being taken in Waltham, by Mr. L. L. Thaxter. In the September number Mr. T. Martin Trippé mentions that he has obtained a bird of the same species (*T. nanus*) near Orange, N. J. The specimen described by Mr. Samuels being brought to me for identification, I had an opportunity of examining it several months before Mr. Samuels's notice of it appeared in the NATURALIST, and I unhesitatingly pronounced it a young bird (probably of the first year) of *Turdus Swainsonii*, it differing from average specimens of this species only in its rather unusually small size, and in certain well-marked characters of immaturity. After Mr. Samuels's account of it appeared, fearing I might have been mistaken, I sent to Mr. Thaxter for the specimen, and through his kindness was enabled to give it a re-examination. The result was the entire confirmation of my previous conclusion. Mr. Samuels, it will be observed, only compares it with *T. Pallasii*, from which in every way, it is clearly distinct, as he supposed; and hence, from its small size, he hastily concludes it must be the *T. nanus*, which I am sure he would not have done had he also compared it with *T. Swainsonii*. The specimen mentioned by Mr. Trippé, according to his description of it, does not appear to differ much from frequent specimens of *T. Pallasii*, though considerably, as he observes, from the description Mr. Samuels gives of his. As to *T. nanus*, if it be a distinct species, the specimen described by Mr. Trippé might perhaps be referred to it, though *T. nanus* has been supposed to be a western species, representing on the Pacific slope the *T. Pallasii* of the Atlantic. In a paper (now in press) in

the Memoirs of the Boston Society of Natural History, in which we give, incidentally, a review of this group of our Thrushes (sub-genus *Hylocichla* Baird, Review Am. Birds, 1864, p. 12), we attempt to show that it is not a species distinct from *T. Pallasii*, and that specimens entirely referable to it are of occasional occurrence in the Eastern States. *T. Audubonii* is also referred to *T. Pallasii*, *T. ustulatus* to *T. fuscescens*, and *T. Allice* to *T. Sealei*. For a more detailed notice of Mr. Samuels's specimen, and a discussion of the nature and relations of these supposed species, the reader is referred to the paper above cited (Mem. Bost. Soc. Nat. Hist., Vol. I, p. 508, et. seq.).

Respecting the "bluish purple tinge" presented by the tail feathers of both Mr. Tripp's and Mr. Samuels's specimens, it is a character of no uncommon occurrence in all the Thrushes, as well as in the Fox-colored Sparrow (*Passercula iliaca*), the Song and other Sparrows and birds possessing a rufous tail, especially in young birds and in those that have recently moulted, not being a specific character at all, but generally a mark of fresh plumage.—J. A. ALLEN, Cambridge.

THE BARN OWL IN PENNSYLVANIA.—During the last year we have captured the "Barn Owl" (*Strix pratensis* Baird) in a high church steeple in this city (Lancaster), which is almost as rare a bird in this latitude as the Golden-eagle, although I am informed that it is more common in Maryland and Virginia. I visited their nesting place and obtained some of their voided pellets, four eggs, and two of their young,—the one just before its exclusion from the egg, and the other when it was six weeks old. So rapid is the development of this bird, that in six weeks it had increased, from less than a half ounce in weight to more than a pound, and in volume, to near the size of the adult. When it was prepared and mounted, the pin-feathers were just appearing in the wings and tail; otherwise, it looks like a mass of white cotton wool, or down, with formidable feet, beak, and eyes "stuck in," after the manner of making toys. Although I visited this "owlery" on several occasions, I never found the adults "at home," and the eggs were always exposed and quite cold. The young were excluded about the 27th of September. The pellets were composed of the bones and hair of mice and moles.—S. S. RATHVON, Lancaster, Pa.

WILSON'S SNIPE.—In reply to a note contained in the Natural History Miscellany, stating that W. A. Pope "has observed the *Scolopax Wilsonii* sitting on the top of a tree, at least thirty feet from the ground," and asking "if other ornithologists have observed this peculiarity," we would state that we once flushed a Snipe which flew from the ground and immediately perched on the dry limb of a tree about twenty feet high, from which we shot the bird, induced by its extraordinary position, although contrary to our principles and practice as a sportsman. An old hunter, present on the occasion, averred that he had witnessed more than once a similar departure from the ordinary habits of the snipe.—J. M. H., Kalamazoo.

CARBOLIC ACID FOR PRESERVING INSECTS, ETC.—During the present summer I have used as a preservative fluid, an alcoholic solution of carbolic acid,—about four grains to the ounce. After killing the insect with chloroform, which I prefer, I thoroughly paint it with this preservative fluid and then dry it in the sun. During the past two months I have had a number of insects thus prepared, mostly Lepidoptera, pinned to the wood-work in my office, thus freely exposed during a season which has been very favorable for their destruction, and they now look as fresh and beautiful as on the day they yielded themselves as martyrs to the cause of science. I am well pleased with the action of carbolic acid, and feel satisfied that it is a sure protection and preservation. In stuffing animals, I use cotton soaked in this same alcoholic solution. Neither do I think it necessary to skin them as formerly, but simply remove the contents of the thorax and abdomen. Specimens prepared thus, a month ago, are now in good condition.—S. B. P. KNOX, M. D., *Brownsville, Pa.*

ALBINO ROBIN.—On the 19th of September, 1868, I shot at Marshall, Michigan, and preserved a specimen of *Turdus migratorius*, which is nearly white. The wing quills and tail are a creamy or soiled white. The upper parts darker, inclining to ash, and the breast and under parts lemon color, with the tips of the feathers white. Bill and feet bright yellow; eyes black. The general appearance of the bird when flying was white. Throat pure white.—D. DARWIN HUGHES.

KINGFISHER'S NEST AGAIN.—I examined two in Ohio; the entrance to the first was on the west side of a bank, some twenty inches from the surface, the tube did not curve, but was so straight that I could plainly see the nest, which was about twenty-eight inches from the mouth of the tube. The second was fully four feet deep, but straight as the other. I did not then notice the substance of the nest. The nests were somewhat higher than the mouths. Both contained young, the first seven and the second four.—P. G. MARCH, *New York.*

THE COW-BUNTING.—It would, perhaps, be interesting to know how many of our birds the Cow-bunting chooses as foster parents to her young. During the present season I have known the eggs of this bird to be found in nests of the *Sayornis fuscus* (Common Pewee), *Empidonax Acadicus* (Green-crested Flycatcher), and *Icteria viridis* (Yellow-breasted Chat), three species which I never knew to be imposed upon before. It is rather unusual for the Cow-bird to choose nests of the true Flycatchers, in which to deposit its eggs, these birds frequently deserting on very slight provocation.

I once found a nest of the *Pyrranga rubra* (Scarlet Tanager), with the female sitting upon two eggs of the Cow-bird. On returning to the spot a few days after, for the purpose of obtaining the eggs of the owner, I was greatly surprised to find two young Cow-buntings in a flourishing condition, but no sign of a Tanager's egg. This was to me quite a new phase in the domestic affairs of birds,—one species building the nest while another furnished the eggs.—T. H. JACKSON, *West Chester, Pa.*

MIGRATION OF ANTS. — On the 17th of June, 1866, I noticed that the ants around my door were unusually numerous and active. They were not running about at random as if hunting for food, but kept in a path a few inches wide, which extended from the door into a neighboring yard. Some of the ants appeared to have unusually large heads, but on closer examination it appeared that each carried another ant in her jaws. If a pair of these were separated they ran about as if dizzy, rubbing their antennae with those of every ant they met. When they had recognized each other by this means of communication, they clasped their jaws together, and raised their heads as high as possible from the ground. The ant, who was to be carried, then curved her body under the head of the other, and drew her feet close to it, so as to hang entirely free from the earth. In this position they were carried with very little difficulty, being entirely out of the way of the limbs of their carriers. Tracing the line of march I found it extended to the door-step of a neighbor, some twenty yards off, passing under a gate and over a step four inches high, and through several yards of ground covered with weeds and ashes. Every ant which left our neighbor's door carried another ant before it, with which it passed all these obstructions, and deposited it safely in the holes at the other end of the route. The ants, travelling in the opposite direction, were all empty handed. This transportation continued for ten days, excepting during a rain. The larvæ and pupæ were carried last. After the migration was finished, the ants settled down to their regular summer work, and appeared only in small numbers in search of food.

In a shady corner under the door-step, the ants brought out the remains of the insects, whose juices they had eaten, and left them in a little heap, from which I took at one time three or four teaspoonfuls of skins and legs, some of them belonging to beetles as large as twenty ants. — J. H. EMERTON.

[Mr. E. Norton informs us that this is the *Formica fusca* Linn. — Eds.]

IS THE CROW A BIRD OF PREY? — In the summer of 1866, while out on a collecting trip with my friends, Messrs. Gill and Smith, about a mile from this city, we saw a crow (*Corvus Americanus* of Audubon) pounce down into a barnyard, after the manner of a hawk, on a brood of young chickens and carry one of them off. The act seemed strange to us at the time, for although we knew that a great part of this bird's food, at this season, consisted of the eggs and young of small birds, yet we had never heard of its capturing its prey in this manner. Can any of our ornithologists tell me whether this is a common practice with this bird or not? — CHAS. H. NAUMAN, Lancaster, Pa.

ALBINISM IN BIRDS. — You can add to the list of Albino birds (page 161), a Reed-bird, shot near Philadelphia; the entire plumage is white, the bill and feet pale flesh-color. Also, a Robin; this is an instance of partial albinism, similar to that of the Blue Yellow-backed Warbler, described by Dr. E. Coues; that is, "the entire plumage is checkered or patched over with white, the normal colors showing in the spaces be-

tween the white." These specimens are in the possession of Joseph W. Drexel, Esq., of Philadelphia, who also has an example of a Ground Squirrel, or Fence-mouse, as it is commonly called, which is, with the exception of the stripes on the back, entirely white; the stripes are pale brownish or yellowish.

I trapped a snow-white specimen of the common rat, and also obtained another one from my friend, Mr. Charles Wood, of Philadelphia, but these, I suppose, are not uncommon.—HERMAN STRECKER.

MIGRATIONS OF BIRDS.—Do our migrating birds ordinarily follow the same route in their annual migrations? I think they do, uniformly, unless thrown out of their course by great stress of weather. In the fall of 1863, one morning I noticed a large flock of robins (*Turdus migratorius*) in my door yard, bathing in a kind of aquarium that I had constructed by excavating the earth and lining it with hydraulic cement. This tank is filled with water and swamp muck at the bottom, in which are growing the white Pond-lily (*Nymphaea odorata*), the leaves of which make a charming place for the birds to bathe and drink. Among the robins I noticed a fine Albino. He, with his *compagnons du voyage*, remained in my yard about half an hour, bathing, drinking, and eating the berries of the mountain-ash.

April came, and one morning my wife exclaimed, "Oh! what a large flock of robins!" I replied, "Look for my Albino," when my ears were greeted with "Yes, here he is, the same bird." He had some markings by which we knew him, two brown quills in his tail, and a few light-brown feathers on each shoulder. As before, they staid with me about half an hour, and passed on. Being sick, I had no expectation of living until fall, and requested my wife to watch for him the next autumn. How often I thought of that bird! shall I live to see him again? will he be alive? I knew he was a mark for the fowler and the naturalist. Fall came, and with it my Albino with a host of companions; they lingered as before, and passed on to the south. I had the same reflections about him and myself as before, made the same request to my wife to watch for him, and if he came again, and I was gone, to report to Professor Kirtland. Fall came, and with it my dear little Albino. Thus for five successive seasons this Albino came and went. Does not this pretty clearly settle the question? Whether he ever came again I do not know, for I sold my place and never heard of him again.—T. GARLICK, *Cleveland, O.*

THE UNICORN OF FABLE.—Mr. Groom-Napier observes that the discovery of the bones of a mammoth (1663) was the foundation of the fossil unicorn of Liebnitz, which the entire skeleton found in Siberia rendered a palpable error. The older naturalists were exceedingly fond of the subject of the unicorn, and the modern have made great efforts to identify the unicorn of the vulgate, which it is almost needless to say, points to an ideal animal, and not to the *viēn*, a two-horned animal, translated unicorn in the Old Testament, and now generally considered to be the *Bos urus*, or wild bull of Palestine, now extinct.—*Land and Water.*

SIREDON, A LARVAL SALAMANDER.—At the last meeting of the Boston Society of Natural History (Sept. 16th), Professor O. C. Marsh, of Yale College, gave an account of some observations which he had recently made on the metamorphosis of *Siredon* into *Ambystoma*, two genera of tailed Batrachians, usually placed in distinct families. During an excursion to the Rocky Mountains in August last, Professor Marsh obtained in Lake Como, a small brackish sheet of water in Wyoming Territory, several specimens of *Siredon lichenoides* Baird, known in that region as the "fish with legs." On bringing them to New Haven, one of them soon showed indications of a change similar to that observed by Duméril, in the second generation of Mexican Axolotls, kept in the Museum of Natural History, in Paris.

The first phase noticed in the transformation, was the appearance of dark spots on the sides of the tail, and soon after the membrane along the back, and especially that below the tail, began to disappear. Next the external branchiæ, or gills, began to be absorbed, and the animal came more frequently to the surface of the water for air. As the change went on, the spots gradually extended over the rest of the body; the membrane of the back and tail entirely disappeared; the external branchiæ, as well as their interior arches, became absorbed, and the openings on the neck closed up. The body also diminished in size, the head changed in form, becoming more rounded above and more oval in outline, and the eyes became more convex and prominent. The opening of the mouth and the tongue both increased considerably in size, the teeth changed in position, and the animal made frequent attempts to leave the water, and at last escaped as a true *Ambystoma*, apparently identical with *A. macrotum* Baird. Subsequently several other specimens underwent the same metamorphosis, during which various experiments showed that the rapidity of the change was greatly affected by variations in light and temperature; the specimens most favored in these respects having passed through the entire transformation in about three weeks. Whether the species ever changes in Lake Como, which is about 7,000 feet above the sea, is uncertain, but that it breeds in the Siredon state, like the Axolotls from the table lands of Mexico, there can be little doubt. This interesting metamorphosis renders it extremely probable, that all Siredons are merely larval Salamanders; and it also suggests a doubt whether some, at least, of the other so-called Perennibranchiates may not be the undeveloped young of well-known species.

THE YELLOW-HEADED BLACKBIRD (*Xanthocephalus icterocephalus* Baird).—We call this the Orange-head, knowing of no name more suitable. They arrive about the first of May, and disappear about the tenth of June. I do not think they breed in this country. They made themselves valuable to the farmers last spring in devouring the swarms of young grasshoppers. I had a lot of land on which the grasshoppers deposited the r eggs by the million; as they began to hatch the yellow-heads found them out, and a flock of about two hundred attended about two acres daily, roving over

the entire lot as wild pigeons feed, the rear ones flying to the front as the insects were devoured. The farmers of Kansas are under great obligations to the little yellow-heads, or, as some call them, copperheads, for their services last summer. — W. J. McLAUGHLIN, *Centralia, Kansas*.

[According to Professor Baird, this bird is essentially a prairie bird, and is generally distributed throughout Western America, from Texas, Illinois, Wisconsin, and North Red River, to California, south into Mexico, and it has also been found in Greenland. — Eds.]

HABITS OF THE COMMON RED FOX.—While among the White Mountains in Stowe, Maine, a hunter told us that the fox comes out of its hiding-place at sunset to catch grasshoppers. At this time, and also at early dawn, they are hunted with the gun. In the winter the fox has been observed leaping vigorously upon the crust of the snow. The farmers say they do so to scare the field-mice out of their retreats beneath, in order to seize them. — Eds.

THE LOBSTER.—It is now almost universally admitted, that, in order to meet the yearly increasing demand, not alone for oysters, but also for lobsters, crabs, etc., some other means of reproduction must be pursued besides leaving them simply to nature to "increase and multiply." This has been so well understood by the pisciculturists in France, that every exertion has been made to resuscitate the fisheries by increasing the produce by "artificial breeding." Many oyster-beds that, a few years since, owing to the "greed" both of the oyster-dredger and the consumer, were completely denuded of oysters, are now in a flourishing condition; and the artificial cultivation, not alone of oysters, but of lobsters, crabs, and other food-fishes (thanks to the genius of M. Coste, Hyacinthe Bœuf, M. le Docteur Sauvè, and other celebrated pisciculturists), has turned out a complete commercial success. The French Government also, alive to the welfare of the fisheries of the coast, has encouraged in every possible manner the maritime industry of the seaboard, and has given concessions of portions of the foreshore to men belonging to the naval reserve, in order to have them artificially cultivated for the production of oysters, lobsters, and other fish. These grants have been availed of to a large extent by the sailors in different parts of France, and have been a source of great profit to them. The Imperial Government has also caused several establishments to be constructed, such as those at "Concarneau," where lobsters and other crustacea are kept in tanks specially made for them, for the purpose of artificial propagation and rearing, whilst in other tanks, sea-fish, fit for food, are kept, so that the pisciculturist is enabled to study the habits of these various fishes, as well as their natural history. Were it possible to induce our Government to introduce similar establishments in this country, we should not now be bewailing the ignorance so much complained of at our recent sea-coast fishery enquiries in the House of Commons, when nearly all the witnesses had to confess they were completely ignorant of the habits, places of spawning, etc., of nearly all the varieties of fish frequenting our shores.

Monsieur Coste, in one of his writings, says: "It would be a great error to believe it were possible to attempt the education of any description of animal whatever, without knowing, at least in a superficial manner, something of its organization." We therefore purpose giving a short account of the natural history of the lobster, trusting to find the example set by the French Government at Concarneau, and followed on a small scale at Hayling, in the south of England, may be farther introduced into this country.

The lobster (*Astacus marinus* Fabr.*) belongs to the tribe of *Decapods*, and, according to La Blanchère, is easily recognized by its shell, which is of a brown, green, and blue shade, intermingled with red lines. The body terminates at the head with a tridented beak, with a double row of teeth on its upper jaw. It has two unequal-sized claws, one oval and powerful, the other more oblong, and small. The exterior antennæ are as long as the body, and are covered with red rings. The eyes are small and round, and of the same size as the peduncles. It has a large stomach and bent tail, terminated by five large swimming blades, serrated at the edges.

M. Coste, in his remarkable report to the minister of the French marine, has given the following description of the manner of the reproduction of the lobster, which will be found exceedingly interesting. "The lobster commences breeding in the month of October, and the pairing takes place sometimes as late as January. The couplings are rare at the opening of the season, but increase in frequency to the end of December, and but few take place in January. The female emits the eggs in about fifteen or twenty days after pairing. When they have reached the stage proper for their expulsion, the female applies the inner side of the tail against the plastrum, or shell immediately over the stomach, in such a manner as to form a cup or cavity, in which is to be found the openings of the oviducts placed exactly behind the third pair of legs. Consequently, when the eggs escape from the stomach, they fall into this natural cup or cavity as described above. They are expelled in successive jets to the number of 20,000 in a single day. The lobster, along with the eggs, emits at the same time a kind of adhesive liquid, which binds the egg one to the other, and attaches them all to the small feet under the tail, where they remain, in perfect shelter from all harm, until they are sufficiently ripe for final expulsion.

"In order to forward and force the regular incubation of the ova, the females have the power to give them more or less light, as they consider requisite, by closing or opening the folds of the tail. Sometimes the eggs are kept quite covered, and at other times they give them a kind of washing by moving the flanges of the tail in a peculiar manner. The incubation lasts six months, during which time the female takes such good care of the ova, that it is rare to find an injured embryo or barren egg. It is during the months of March, April, and May, that the actual birth of the young lobster takes place. When the females, in order to expel the em-

* Our species is the *Homarus Americanus*.

bryos, now ready to burst the shells of the eggs, extend their tails, make light oscillations with the fan and its appendages, so as to rid itself gradually of the young lobsters, which it succeeds in doing in a few days.

"The young lobster, as soon as born, swims away from its parent, rises to the surface of the water, and leaves the shores for the deep waters of the sea, where it passes the earliest days of its existence, in a vagabond state for a period of from thirty to forty days. During this time it undergoes four different changes of shell, but on the fourth, it loses its natatory organs, and is therefore no longer able to swim on the surface of the water, but falls to the bottom, where it has to remain for the future; according, however, to its increase of size, it gains courage to approach the shore, which it had left at its birth. The number of enemies which assail the young embryos in the deep sea is enormous, thousands of all kinds of fish, mollusks, and crustacea pursuing it continually to destroy it. The very changing of the shells causes great ravages at these periods, as the young lobsters have to undergo a crisis which appears to be a necessary condition to their rapid growth. In fact, every young lobster loses and remakes his crusty shell from eight to ten times the first year, five to seven the second, three to four the third, and from two to three the fourth year. However, after the fifth year, the change is only annual, for the reason that were the changes more frequent, the shell would not last long enough to protect the ova adhering to the shell of the female during the six months of incubation. The lobster increases rapidly in size until the second year, and goes on increasing more gradually until the fifth, when it begins to reproduce, and from this period the growth is still more gradual."—R. K. WOOD, in *Land and Water*, London.

GEOLOGY.

WHAT IS A GEODE?—The term *geode* is applied by geological writers to two distinct conditions and character of rocks, in so promiscuous a manner that the reader, without specimens, has no means by which to determine, with any degree of certainty, what it is of which the writer is treating. Let me illustrate by numbered examples:

No. 1. In many rocks there are irregular cavities, of moderate size, whose inner walls are studded with mineral crystals. The walls of these cavities are of the same material as the general mass of the rock in which they occur, and in no way distinguishable from it, the cavity being a mere opening in the general mass of the foundation.

No. 2. Rounded masses of quartz, often Chalcedonic, occurring enclosed in limestone, etc., but as foreign in character, from the mineral enclosing them, as raisins are to the mass of a pudding by which these have been surrounded in the process of cookery. When destructive weathering of the rock containing these takes place, these balls fall out into the soil, where they remain wholly unattacked by the elements.

These silicious nodules vary in size from that of an apple to that of

a human head. They usually enclose a cavity, the walls of which are studded with crystals of one, and often of several minerals, frequently presenting great beauty of appearance. The former of these (No. 1) is abundant in the Niagara limestone of the New York State Survey; while the latter (No. 2) occurs in profusion in the limestones of Indiana, Missouri, and other portions of the Mississippi Valley.

The two objects above described, though so utterly unlike, are without any distinction called *geodes* by geological writers. And why?

That the two objects, so essentially different, should be known by distinctive names seems wholly self-evident. The present usage of writers in coupling both under one and the same name, as they constantly do, is productive of extreme confusion, while the practice is not justified by any apparent necessity whatever. — R. W. HASKINS, *Buffalo, N. Y.*

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.—NATURAL HISTORY SECTION. *Chicago, Ill., August 5-12, 1868.* Gen. G. K. WARREN presented a paper "On certain Physical Features of the Upper Mississippi River." He had been detailed to survey the Upper Mississippi, Minnesota, and Wisconsin rivers, with a view to improving the navigation and constructing bridges which should afford the least obstruction to navigation practicable; in doing this he has reached results, which, besides being important to the objects for which they had been sought, were believed to be of general scientific interest. He had been early impressed by the immense excavations made in the Silurian rocks through which these rivers now flow. This great excavation above the junction of the Minnesota and Mississippi rivers, is occupied, not by the Mississippi river but by the Minnesota river. The bed of this latter, however, for about one hundred and ten miles below Big Stone lake, is partially granitic. Big Stone lake occupies thirty miles of this great excavation, and Lac Travers about twenty. The two lakes are separated by a strip of low land, but a few feet above their level, and about nine hundred and eighty feet above the ocean level. This is a deposit made by the infant Minnesota river as it enters this great excavation, and during heavy rains the streams send their waters to Hudson Bay as well as the Gulf of Mexico. The great excavated valley of which we have been speaking, is at this point about a mile wide, and the bluffs, or sides, composed of boulders and gravel, are about one hundred and fifty feet high. Were one inclined to believe that the present streams in a long period of time would be sufficient to excavate the valley of the Mississippi, he must admit their insufficiency here. In fact these feeble streams, so far from having made this great excavation, are doing their best to fill it up.

Northward from Lac Travers commences a vast lake basin extending continuously to the north end of Lake Winnipeg, including this lake, Lake Winnipigosis and Lake Manitoba. The greater part of this ancient lake-bed is now dry, leaving a well-defined beach to mark its former extent. Although the Red river of the north flows north along the lowest line of this bed, he concluded that the waters of this basin once flowed southward, through the Minnesota river, into the Mississippi.

The present level of Lake Winnipeg, according to Mr. Hines, is six hundred and fifty feet above the ocean. To cause the waters to flow southward again, with the present levels of the land existing, would require the lake to be raised three hundred and thirty feet. It is obvious this could not be done while the Nelson river outlet existed. There is no good description of this outlet, as it is never used for a line of communication; it abounds in rapids and falls, which seem to show its recent origin. If we suppose the ice of the glacial period to have closed this, it would have given the lake the whole extent of the basin, and caused its discharge southward; but this will not account for all the phenomena observed.

A more satisfactory explanation of a change of outlet from a southern to a northern one, is to attribute it to a northern depression of the basin; for it is found that Lake Michigan formerly had a southern outlet through the Illinois river, and Lake Winnebago also had a much greater extent and a southern outlet. The shores of all the lakes show the water to be receding from their southern ends and encroaching upon the northern. This northern depression is known to be going on along the Atlantic coast from New Jersey to Greenland.

Gen. Warren said that further consideration had shown him that all the waters of Winnipeg basin, even if they had continued to flow southward could not have excavated the passage-way now occupied by the Minnesota and Mississippi rivers, and that we must go farther back in time to reach a sufficient cause. In doing this we must first consider the character of the rivers which existed in this region previous to the glacial epoch. During the Cretaceous period we know that an ocean extended from the present Gulf of Mexico to the Arctic Ocean, covering a large portion of the space between the Missouri and Rocky Mountains. At that time the upper country through which the Mississippi now flows was dry land, and its slopes must have sent its waters westward to the Cretaceous ocean. As the continent rose this Cretaceous ocean disappeared, and the Tertiary period began with great fresh-water lakes along the base of the Rocky Mountains; into these lakes the waters of the Upper Mississippi region continued to drain westward. The gradual south-western elevation of the continent throughout the Tertiary period is distinctly proved by the deposits of these Tertiary lakes. The earlier deposits were of least area, and as they become more recent they expand north-eastward, and this continued apparently to the time preceding the glacial epoch. This elevation at the south-west seems to have been in progress from the earliest

geological epoch; every contemporaneous formation being found in the mountain regions of the south-west higher than to the north-east.

Preceding the glacial period, then, all the water-courses of the Upper Mississippi region were westward, and not southward as now. Not only the slope of the land, but the great folds of the Silurian strata compelled the water to take this course. Over a great deal of the region thus drained, no rocks more recent than the Silurian are found, so that it must have been dry land since the Silurian period. In the immense ages succeeding, this dry land was exposed to all the atmospheric influences, and we can conceive how it must have been cut up by ravines and valleys encroaching on each other in endless confusion, as we now see in the bad lands of Nebraska. Even the hard azoic rocks forming the dry land of the Silurian period must have exhibited the most stupendous atmospheric erosions. These preglacial erosions can still be distinguished from those more recent. When, then, the glaciers came it would seem that their work was easy, and they have planed down the whole region, removing Silurian strata several hundred feet in thickness, over hundreds of miles. The whole Upper Mississippi region was the scene of the drift action, and the valleys of preëxisting rivers were filled up and mostly buried out of sight. The existence of a distinct glacial moraine at Warsaw, on the Mississippi, shows that the glaciers were at least that far south.

He had determined the south-western limit of the glacial or drift action to be the Missouri river, from about the 48th down to the 43d parallel of latitude. The modified drift forms the grand Coteau du Missouri, lying on its east bank, and this material extends thence north-eastward almost continuously. From the Missouri river to the Rocky Mountains, a distance varying from three hundred to five hundred miles, no drift is found except that due to local glaciers of the mountains, which, in some places, extended for fifty miles east of their bases. The existence of this space between the Missouri river and the Rocky Mountains shows that the form of the continent and seas in the glacial time were such as to produce in the climate relations similar to what now exist: namely, that the mountain region to the west intercepted the moisture as now from that direction, and that the supply for the Mississippi valley came from the south as at present, moved with the winds in a north-easterly direction as now, and left an arid region such as we now have along the plains east of the mountains. Since low temperature and moisture combined are required to produce a glacier, it follows that either high temperature or aridity would arrest their formation. If high temperature limited them southward and aridity westward, the limiting line would have taken a north-west and south-east direction, somewhat as the summer isothermal line does now. The motion of the glacial mass must have been along the line of least resistance, and towards this limiting line, and the glacial scratches in the Upper Mississippi region show that the motion was south-west. There, then, on that limit a river must have formed, to carry away the melting

water from the glacier, and this limit was the Missouri river, and that was the river formed thereby. It cut along this glacial limit because all the streams west of it came from the mountains toward it, and there their old course was terminated. We see what lakes must periodically have formed here, what great barriers must have been formed and burst one after another, and what deluges the lower valley must have experienced. When the glaciers began to retire to the north-east, as long as the general slope of the continent was towards the glacial mass, successive rivers were marked out by it along its western face, and all have a parallelism, and are close to each other, and have short tributaries or parallel branches if any. They are, besides minor streams, the James river, the Big Sioux river, the Des Moines river, the Iowa and Cedar rivers, and finally the Minnesota and Mississippi rivers, the last of the parallel series. After the lowest line of the continental valley was passed, the glacier would begin to retire in such manner that the melting water would run directly from it, and such we see is the direction of all the tributaries of the Mississippi on the east side. This direction corresponds with that of the preglacial rivers, and it is probable that some of them, such as the St. Croix river, Chippeway river, Wisconsin river, etc., washed out and regained their old beds, for so their appearance would indicate.

The bend of the great valley along the Minnesota river, between Mankato and St. Paul, being at right angles to the main course of all these parallel glacial rivers, would seem to disprove the view that the formation of this river took place along the glacial margin. But it probably is the bed of one of these preglacial rivers, as it lies in the proper fold of the Silurian rocks and seems to have been formed in an ancient valley. From St. Paul southward, however, the present course of the Mississippi is cut square across this fold in the rocks, and the glacial action is the only explanation of it.

The manner in which the glacial action produced these valleys was not by abrading the strata with the grinding power of rocks embedded in the ice, but after the manner in which a block of marble is sawed. The glacier supplied an immense power in the melting water, and into this water it was constantly dropping sharp rocks and sand.

The waters issuing from a lake have little abrading power, for they have comparatively little rubbing material to operate with. Thus it was that the waters issuing at the old southern outlet of Lake Winnipeg could make no impression on the granitic bed of the Minnesota. Had this material been soft like the Silurian rocks lower down in its course, or like the Tertiary and Cretaceous rocks through which the Missouri has cut its way, then this part of the valley would have been worn away in the same manner, and we should have the drainage of all the Winnipeg basin still to the southward. A cut of four hundred feet at Big Stone lake would have drained it, nor would the banks then have been as high as those of the Missouri, at the Bijou hills, which are eight hundred feet above the water of the river. The slope of the Missouri is more than double that

of the Mississippi, and hence the water of the Missouri river is several hundred feet higher than that of the Mississippi, at points in the same latitude in their upper courses. An examination of the bluffs along the Mississippi shows that the space between them is on the whole quite uniform in width, gradually increasing downward, being about a mile at Big Stone lake, and reaching six to ten miles at Commerce; below this the space widens out to from forty to sixty miles. Sometimes the river, as at the "Grand Tower" and at "Le-montagne-qui-trempe à l'eau," and several other places, is found flowing between bluffs not even a mile apart; but the bluffs on one side or the other are always found to be a detached mass, and the main valley exists there too.

Two remarkable exceptions to this occur at the rapids,—one at Keokuk, the other at Rock Island. Without lengthening this paper to such an extent as would be necessary to go fully into an explanation of these exceptions, he stated that after being long puzzled by them, he discovered that the whole valley had been covered with an extension of the Gulf since the glacial period as high up as Savannah or Dubuque; that the silt brought in by the Des Moines river in the one case, and by the Iowa and Rock rivers in the other during this period, entirely filled up the bed cut out by the great glacial river, and that when the land rose again, the Mississippi could not at these points regain its old bed. So it had to cut a new one, and this it has not yet completed. The space between the bluffs at these two places has the width the present river requires, and it is so nowhere else in its whole course.

It might be thought that these investigations do not affect the question of improving the navigation of the rivers or bridging them. In removing obstructions we have two kinds to deal with, such as arise from causes not now operating, and which once removed would not recur, and those from causes that are now operating and which must be constantly recurring unless the cause itself is removed. The discussion given forms the bases of a proper discrimination of these causes. The question of bridging the Mississippi keeps in view largely the action of the stream and the character of its bed. The usual argument that the scouring action that has been in operation may take place again, must not be applied here till we can separate the observed effects of such agencies as here treated of from those now at work. Instead of probing with an iron rod every inch of the bed before we can determine the practical depth at which firm rock may be reached, we have here established general conclusions, which settle the question for all points at once. This is illustrated by referring to what took place all along the Mississippi, when the Winnipeg basin ceased to discharge its waters southward. The former river, which bore along all the sediment brought by its tributaries, was gone. Everywhere along its course these tributaries continued to deposit at their mouths the sand and heavy material as before, and there it accumulated till a lake gradually grew above each point of junction. The waters of each lake gradually spread this material down the valley, and encroached upon

the lake below it, as a delta advances into any body of water into which a stream flows. These lakes in most cases were thus gradually filled up, leaving countless delta islands in their place, but Lake Pepin still exists made by the sands deposited by the Chippeway. Lac qui Parle and Big Stone lake, on the Minnesota river, are of the same kind. The depth of water in these lakes is still fifty to seventy feet or more, so that having thus accounted for their origin, we have in their depth the least measure of the depth of sand above and below them. There is no need, when we know how this river passage was made, to sound in order to get the depth of the sand. We know the foundation everything must have that crosses the valley of the Mississippi. The exceptional cases at the rapids I have explained.

So far what is said is mainly in the way of a demonstration to account for "Certain Physical Features of the Upper Mississippi river." The grandeur of the subject he had tried to keep from influencing his observation and deductions therefrom. But part of the facts by which the conclusions are reached are here given, nor are all of the inferences drawn which the facts presented will warrant.

He hardly knew how much of what he had said is derived from others. He had consulted some of the most distinguished geologists on the general subject. He was particularly indebted to Mr. James E. Mills of New York, whose investigations of the gradual northern depression going on along the Atlantic coast, suggested to him to account for the change of outlet of Lake Winnipeg in the manner above. He believed his observations in themselves demonstrate this depression to be going on along the great central valley, so that we are authorized to conclude that it probably embraces the whole continent. This must affect all the rivers and all the lakes, bays and oceans around us, and so far as his observation and reading extend, they all give the same proofs of it. It is, however, a field for many observers, and he ventured this incomplete showing, so that others who have the opportunity, and deem it worthy of their efforts, may help along the investigation.

KENT SCIENTIFIC INSTITUTE. *Grand Rapids, Mich., Sept. 11, 1868.*—Mr. A. O. Currier presented a paper for publication, entitled "A List of the Shell-bearing Mollusks of Michigan, particularly of Kent and adjoining counties." The list contains all the species heretofore described, and several new to science, of which descriptions exist only in the manuscript of Mr. Currier.

Mr. George W. Smith gave an account of a series of examinations made of a group of ancient mounds situated four miles below the city, on low ground adjoining the Grand Rapid river. The group consists of thirteen mounds, and is placed upon an area 700 by 400 feet. The mounds vary in height from five feet to over twenty-five, and in diameter from twelve to over sixty feet. They appear to have been constructed on no decided plan, but run promiscuously in a direction nearly east and west. Their character, or that of their builders, are unknown to the present race of

Indians who have inhabited the locality for many generations. Trees three and four feet in diameter lie in a state of extreme decay on many of the mounds, while hardwood trees, quite as large, grow luxuriantly on nearly all of them. Several of the mounds have been explored quite thoroughly. Two vases of pottery, copper and stone implements, bone-needles, and a piece of wicker work, very unique, and probably intended for a basket, were found. The latter was too far gone to be saved. Pieces of flint were also seen strewn in one mound. The vases of pottery rested on a hard loam foundation, a few feet square, and in both cases on a level with the ground. Layers of ashes and burned earth appeared frequently in the excavations. The builders, probably, belonged to the race whose monuments are so numerous farther south.

ANSWERS TO CORRESPONDENTS.

P. G. M., New York. — 1) We cannot give the number of known species of Kingfishers in the world. Mr. Cassin, in his catalogue of the specimens of the family contained in the large ornithological collection of the museum of the Philadelphia Academy of Natural Sciences, published in 1852, gives ninety-one species from various parts of the world. (2) We do not know what is meant by Kinghunters. (3) It is well, in order to avoid being led into error, to question much that is given in works of a popular character, unless the statements are taken from a well-known authority on the subject, and even then you must remember that the most noted naturalists have sometimes made statements which farther research has shown not to be true. In general, the work you refer to is as reliable as most compilations.

J. C. C., Notre Dame, Ind. — We have printed labels of the Family and Generic names of the Hymenoptera and Lepidoptera, and are gradually printing those of the other orders of Insects. We also have printed labels of the different States of the Union, and localities in Mexico, Central America, etc., in small type, and abbreviated for pinning under insects. Also blank labels, with a red border, for filling out with a pen. We shall advertise these as soon as we have some others printed, but in the meanwhile we could furnish any of them at a fair price.

E. O., Yellow Springs, O. — We send the names of the beetles remaining unnamed from your collection: 1, *Nebria pullipes* Say; 2, *Chlenius tricolor* Say; 4, *Dicelus purpuratus* Bon.; 5, *Bembidium chalcum* Dej.; 6, *Dicelus teter* Say; 7, *D. sculptilis* Say; 8, *Anomoglossus emarginatus* Say; 9, *Stenolophus ochropeus* Say; 10, *Chlenius rufipes* Dej.; 11, *Pterostichus (Paeilus) lucubundus* Say; 12, *Platynus sinuatus* Dej.; 13, *Chlenius bipunctata* Dej.; 14, *Pterostichus (Omaseus) mutus* Say; 15, *Bradycellus vulpeculus* Say; 16, *Pterostichus (Paeilus) occidentalis* Dej.; 17, *Helluomorphia laticornis* Dej.; 18, *Ausodactylus nigerrimus* Dej.; 19, *Dacne heros*; 21, *Staphylinus maculosus* Grav.; 22, *S. mysticus* Erich.; 23, *S. cinnamomeus* Grav.; 24, *Cremophilus villosus* Grav.

E. P. A., Milwaukee, Wis. — 1, *Geopinus incrassatus* Dej.; 2, *Chlenius sericeus* Forst.; 3, *Paeilus*, species?; 4, *Calosoma calidum* Fabr.; 6, *Archopalus fulminans* Fabr.; 7, *Elaphidion mucronatum* Say; 8, *Clytus campestris* Oliv.; 9, *Clytus marginicollis* Laporte; 10, *Physocnemum brevicorneum* Say; 11, *Hylobius pube* Herbst; 12, *Sphenophorus* sp.? 13, *Sphenophorus rufescens* Say?; 14, *Balaninus rectus* Say; 15, *Aphodius fuscicornis* Linn.; 16, *Dichelonychia* sp.?; 17, *Eumylus arcatus*; 18, *Doryphora 10-lineata*; 19, 20, *Mysis 15-punctata* Oliv., varieties; 21, *Disomycha pluriligata* Lee.; 23, *Coccinella bipunctata* Linn.; 24, *Phyllotrochica*.

We would like more specimens of those numbered 5, 6, 7, 10, 15, 16, 22, by E. O., and 10, 12, 13, by E. P. A.

J. H., Albany, Oregon.—The insects were duly received. Any specimens from Oregon are very desirable. Preserve all beetles, bugs, and Hymenoptera (bees, wasps, ants, etc.), in alcohol or whiskey. Place butterflies and moths in folded papers. The rock specimen was volcanic tufa. We will answer your enquiries, regarding the plants, in our next number.

L. M., Norwich, Conn.—Harris's Catalogue of North American Spingies is in Silliman's American Journal of Science and Arts, Vol. 36, p. 282. 1839.

A. P. Hudson, Ohio.—Mr. W. V. Andrews has changed his address to West Hoboken, N. J. He expects to have some eggs of the *Yama-mai* moth next spring.

T. L. M., New York.—The fly-parasite of *Orgyia* was a species of *Tachina*, which, like *Ichnumon*, is parasitic on caterpillars. The species of this and the allied genera are internal parasites.

J. M., Belleville, Canada.—We shall print your notes in our next number. Brief botanical notes would be welcome to the NATURALIST. We would print the most useful.

A. W., Boston.—The third number of the GUIDE TO THE STUDY OF INSECTS was delayed until October 10th, owing to the failure of the party doing the electrotyping. Number four will be issued as early in November as practicable.

BOOKS RECEIVED.

A Treatise on the Artificial Propagation of certain kinds of Fish. By T. Garlick, M. D. Cleveland, 1857. 8vo.

Extra Digils. By Burt G. Wilder. Boston, 1868. 8vo, pp. 20.

A Conspectus of Botanical Terms which are used in the Description of Flowering Plants. Bowdoin College, 1868. 16mo, pp. 12.

Journal of Travel and Natural History. Vol. 1, No. 4, 1868.

The Tin Bunker Papers. New York, Orange Judd & Co. 1868. 12mo. With illustrations by Hoppin.

Archiv der Anthropologie. Edited by A. Ecker and L. Lindenschmidt, Braunschweig, Prussia. Vols. 1; 2, parts 1-3. 1866-'8. 4to.

A System of Mineralogy. Descriptive Mineralogy, comprising the most recent discoveries. By J. D. Dana, aided by G. J. Brush. Fifth edition. Rewritten and enlarged, and illustrated with upwards of 600 wood-cuts. New York, 1868.

Constitution and By-Laws of the Entomological Society of Canada. 8vo, pp. 4.

The Canadian Entomologist. Vol. 1, No. 2. September, 1868.

The American Entomologist. October, 1868. St. Louis, Mo. 8vo.

How Crops Grow; a Treatise on the Chemical Composition, Structure, and Life of the Plant, for all Students of Agriculture. With numerous illustrations and tables of analysis. By S. W. Johnson. New York, Orange Judd & Co. 1868. 12mo.

Journal for the Popular Diffusion of Natural Science. Vol. 5, No. 3, 1868. Copenhagen. *Oreographic Geology; or, the Origin and Structure of Mountains.* A Review. By G. L.

Vose. Boston, Lee & Shepard. 1866. 8vo.

Cosmos. September 12, 19, 26. Paris.

The Field. August 21, 29; September 5, 12, 19, 26. London.

American Bee Journal. October. Washington, D. C.

Chemical News. August, September, October. New York.

Science-Gossip. September. London.

Annual Report of the State Mineralogist of the State of Nevada, for 1866. Carson City, 1867. 8vo.

Natural History of Birds. Lectures on Ornithology, in ten parts. By Grace Anna Lewis. Part 1, 1868. Philadelphia, J. A. Bancroft & Co. 12mo, pp. 32.

